DOCUMENT RESUME

ED 473 381 IR 058 611

TITLE	Proceedings of the International Academy for Information Management Annual Conference (15th, Brisbane, Australia, December 6-10, 2000).
INSTITUTION	International Academy for Information Management.
PUB DATE	2000-00-00
NOTE	368p.; For selected individual papers, see IR 058 612-629.
PUB TYPE	Collected Works - Proceedings (021)
EDRS PRICE	EDRS Price MF01/PC15 Plus Postage.
DESCRIPTORS	Computer Assisted Instruction; Computer Mediated Communication; *Computer Uses in Education; *Conference Proceedings; Cooperative Programs; Distance Education; *Educational Technology; *Information Management; Information Science; Information Systems; *Information Technology; Instructional Design; Nontraditional Education

ABSTRACT

This document presents proceedings from the International Academy for Information Management (IAIM) annual conference, held December 6-10, 2000 in Brisbane, Australia. Papers include: "Metacognitive Miscalibration and Underachievement in a Computer Literacy Course: Some Preliminary Observations" (Deborah K. Smith, William Wittman, C. Bryan Foltz.); "Knowledge Discovery in Database Techniques Applied to Students Recruitment Systems in Universities" (Ahmed El-Ragal, Terry Mangles); "Using Heuristic Self-study to Research Information Systems Education" (Mark Campbell Williams); "Problem-based Learning Assessment for Information Systems Courses" (Willie Yip, Ahmad Ghafarian); "The Role of Personal Experience and Social Interaction in Knowledge Creation and Utilisation" (Meliha Handzic, Denise Tolhurst); "The Learning Effectiveness of Instructional Technologies: Results from Pilot Studies" (Katia Passerini, Mary J. Granger); "A Survey of Electronic Business and Electronic Commerce Degree Programs" (Margaret T. O'Hara); "Experiential Learning in the Introductory MIS Class: Interviews with IT Professionals" (Margaret T. O'Hara, Charlotte Stephens); "Evaluating Procedural Knowledge in Information Systems Students" (Creggan Gjestland, J. Ellis Blanton, Cindy LeRouge, Jim Nohelty); "Wisdom and the IS Curriculum: Is Ethics Necessary?" (Peter Anderson, Louis Sanzogni); "Information Technology Partnerships Between Industry and Academia" (Doris Duncan); "Contextual Differences Between Education and Training in MIS Curriculum Development" (Susan K. Lippert, Mary J. Granger, Tom Case); "Fact or Fiction: Entry-level College Students Are Ready for an Advanced Computer Applications Course" (Sharlett Gillard); "Asynchronous Learning Tools in the Traditional Classroom--A Preliminary Study on Their Effect" (James E. Novitzki); "University Internet Services: Problems and Opportunities" (Dien D. Phan, Jim Q. Chen); "Teaching Systems Analysis and Design to a Mixed Class of CS and BIS Majors" (Olga Petkova); "Comparing the Importance of IT Job Skills in Australia and the United States" (Craig Van Slyke, Liisa von Hellens, Kevin Elder, Marcy Kittner); "An Exploratory Study of the Factors Contributing to MIS Student Organization Effectiveness" (James R. Buffington, Joseph T. Harder, Jeffrey S. Harper); "'Seamless' or 'Info-mediated' Electronic Marketplaces: A Research Note"(Nada Korac-Kakabadse, Alexander Kouzmin, Andrew Korac-Kakabadse); "Team Process Constraints: Testing the Perceived Impact on Product Quality and the Effectiveness of Team Interactions" (Charlotte S. Stephens, Martha E. Myers);

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"Teaching Information Systems Development (ISD) Using 'Virtual Team' Projects" (Suprateek Sarker, Francis Lau, Sundeep Sahay); "Integrating Project Management into IS Curricula"(David Watson, Heidi Winklhofer, Louis Sanzogni); "Program Assessment in an Undergraduate Information Systems Program: Prospects for Curricular and Programmatic Enhancement" (James B. Pick, Jeff Kim); "Improving Teaching Effectiveness Understanding and Leveraging Prior Knowledge for Student Learning" (Annette Jones, Nelly Todorova, John Vargo); "The Radical Model--A Painless Way to Teach On-line" (C. Romm, W. Taylor); "A Review and Assessment of Teaching COBOL in an IS Program" (Diane Fischer); "Experiences on Using a Business Game as Part of an Information Systems Course" (Timo Lainema); "Online Courses and Collaborative Learning: Underlying Philosophies and Practices" (Tim S. Roberts, Celia T. Romm, David Jones); "Teaching for Learning in IS Education: Assessing the Effectiveness of Small Group Problem-solving/ Discussion Events in Large Class Teaching" (Annette Jones); "Towards a Research Model for Distance Education--Contributions from the Telecommuting Literature" (Geoffrey N. Dick); "Issues in University Administration Systems: A Regional Australian Case" (Dave Oliver, Celia Romm); "Strengths and Weaknesses of an Information Systems Program: A Longitudinal Assessment of Student Perceptions" (Susan Rebstock Williams, Barbara A. Price); "Towards a Knowledge Management Model for the Information Management Curricula" (Dennis Dunn, Ray Hackney); "Teaching Information Systems and International Students: A Qualitative Examination of the Cultural Differences in Computer Supported Group Work" (Nasrin Rahmati); "Rapid Curriculum Development: Fast-track Creation of a School of Information Technology" (O. Maxie Burns, Thomas L. Case, Cindy H. Randall, Susan R. Williams); "The Use of Social Translucence in a Distance Education Support Environment" (Nicolau Reinhard, Wilson Yonezawa, Eduardo Martins Morgado); "Training Students in Distributed Collaboration: Experiences from Two Pilot Projects" (Bjorn Erik Munkvold, Lars Line); "Teaching IS Soft Skills to a Diverse Student Population: Case Studies Using JAD and Cooperative Learning Techniques" (Theda Thomas, Carina de Villiers), and others. (MES)

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Proceedings of the International Academy for Information Management

(IAIM) Annual Conference

(15th, Brisbane, Australia, December 6-10, 2000)

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International Academy for Information Management
15th Annual Conference
December 6-10, 2000
Brisbane, Australia

Conference Program

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"Contextual differences between education and training in MIS curriculum development"

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METACOGNITIVE MISCALIBRATION AND UNDERACHIEVEMENT IN A COMPUTER LITERACY COURSE: SOME PRELIMINARY OBSERVATIONS

Deborah K. Smith
East Carolina University

William Wittman
East Carolina University

C. Bryan Foltz
East Carolina University

ABSTRACT

Metacognition, literally thinking about thinking, is a term used by cognitive psychologists to refer to our ability to monitor our own performance on cognitive tasks. The term also addresses the ability to assess our level of knowledge and skill in a given domain. Behavioral and psychological researchers frequently solicit metacognitive judgments from research participants in the form of self-assessment survey items. However, evidence suggests that our metacognitive judgments are often at odds with reality. The term metacognitive miscalibration is used to refer to this disparity between self-assessments and more objective measures of ability and performance. The authors have theorized a relationship between metacognitive miscalibration and underachievement in courses where many students enter the class believing they already know the material. This paper reports preliminary results from an ongoing study seeking to understand the relationship between metacognitive miscalibration and underachivement in a computer literacy course.

INTRODUCTION

"Professor Smith, I want to talk to you about my exam. I'm really surprised at my grade. I mean, I come to class everyday. I really know this material. I took computers in high school. And I felt really good about the exam. I just don't understand how I could have gotten such a low grade. Is there any chance there was some kind of mixup in the grading or something? I just know I didn't fail that test."

What causes students to maintain such a high opinion of their performance in the face of overwhelming evidence to the contrary? Is it possible that this phenomenon in some way impairs the student's ability to learn? If so, might it be possible to correct the student's misconceptions and, thereby, improve learning?

These questions form the basis of an ongoing research project, originally proposed in Smith and Foltz (2000), examining the relationship between metacognitive miscalibration and underachivement. The goals of this research are to develop an instrument that will identify students who are highly miscalibrated, examine the relationship between miscalibration and course performance, search for ways to recalibrate students' metacognitions, and, finally, determine whether recalibration improves course performance.

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METACOGNITIVE MISCALIBRATION

Metacognition is not to be confused with affect. Some early reviews of this work suggested including studies of students' attitudes toward computers in the literature review. While affect may influence metacognition, whether students like computers or feel good about using computers, the subject of many MIS educational studies not cited here, is not the subject of this research.

Metacognition, literally thinking about thinking, is a term used by cognitive psychologists to refer to our ability to monitor our own performance on cognitive tasks. The term also addresses the ability to assess our level of knowledge and skill in a given domain. Behavioral and psychological researchers frequently solicit metacognitive judgments from research participants in the form of self-assessment survey items. However, evidence suggests that our metacognitive judgments are often at odds with reality (Kruger & Dunning, 1999). The term metacognitive miscalibration is used to refer to this disparity between self-assessments and more objective measures of ability and performance.

Psychological researchers have several theories to explain metacognitive miscalibraton. At the cognitive level, the cue familiarity theory (Metcalfe et al., 1993) essentially restates the old cliché, "a little knowledge is a dangerous thing." When people have some knowledge of the domain in question, they are likely to have higher metacognitive judgments than when they have no knowledge of the domain. At the social level, the above average effect (Dunning et al., 1989; Alicke et al., 1995) simply says that people have higher opinions of themselves than of others. These self-serving assessments tend to increase with the ambiguity of the trait being assessed (Dunning et al., 1989) and the level of abstraction in the comparison (Alicke et al., 1995).

Regardless of the source of metacognitive miscalibration, psychological and educational researchers have related degree of miscalibration to both prediction of performance on multiple-choice exams (Sinkavich, 1995) and actual exam performance (Shaughnessy, 1979). There seems to be general agreement that competence begets more accurate metacognitions (Maki et al., 1994; Kruger & Dunning, 1999; Shaughnessy, 1979; Sinkavich, 1995). One study suggests that gaining competence in the domain is the only way to correct metacognitive miscalibration (Kruger & Dunning, 1999).

Of more practical concern is research suggesting that metacognitive judgments influence decisions to continue work on a problem (Metcalfe, 1998) and studying (Bjork, 1996). This being the case, improving metacognitive judgments – metacognitive recalibration – should produce better results in courses where students are highly miscalibrated. However, if Kruger and Dunning are correct in their assertion that only domain competence will result in recalibration, then we are at an impasse.

RESEARCH METHOD

A 50-item multiple-choice quiz was developed as a comprehensive test of course knowledge. Questions covered eleven subject areas, with no fewer than four and no more than six items in each area. Of the five possible responses for each item, the last was "I don't know," and the remaining four did not include any obviously incorrect choices. (For example, when asked who is credited with designing the first computer mouse, Walt Disney would be considered an obviously incorrect choice.) Four metacognitive instruments were developed, soliciting students' self-assessments of their course knowledge relative to their peers.

Participants were students enrolled in two summer sections of a computer literacy course, taught by the same faculty member. A total of 33 students completed the course pretest; 23 completed the posttest. The course pretest, administered on the first day of class, consisted of the first metacognitive instrument, followed by the multiple-choice quiz, followed by the second metacognitive instrument. The course posttest, administered on the last day of class, prior to the final exam, consisted of the third metacognitive instrument, followed by the multiple-choice quiz, followed by the fourth metacognitive instrument. Students were instructed to choose the "don't know" response if they were unsure of an answer on the multiple-choice quiz. Students were not compensated in any way for participation and were not informed of either their individual performance or the aggregate class performance on the quiz.

RESULTS

Following the pretest, the multiple-choice quiz was scored and number of correct, incorrect, and don't know responses recorded for each participant. The mean and standard deviation of correct responses was used to construct five groups of students: far below average, below average, average, above average, and far above average. These groups correspond to response options on the metacognitive instruments. The range of correct responses labeled as average was defined as one standard deviation, centered on the mean. Above average was defined as the 1.5 standard deviations beyond average; far above average as the final two standard deviations. Below average and far below average were similarly defined. However, due to the low mean value and the large standard deviation, there were no observations in the far below average group. There was only one observation in the far above average group; this was discarded as an outlier. This left seven students in the below average group, eleven in the average group, and four in the above average group. Figure 1 shows the mean number of correct, incorrect, and don't know responses in each of the three pretest groups.

Item two on the first metacognitive instrument asked participants to rate their "knowledge of concepts and skills to be covered in the course," relative to their classmates.

Response options were far below average, below average, average, above average, and far above average. The corresponding item on the second metacognitive instrument asked participants to rate "overall performance on the pretest," again relative to their classmates. Figure 2 shows the nominal line representing perfect calibration and the mean response for each pretest group on both the first and second metacognitive instruments. The distance between the nominal line and the actual mean represents the magnitude of miscalibration for the group. The average and above average groups were well calibrated, though their self-assessments were somewhat below their actual performance. As anticipated the below average group overestimated their performance, though not to the degree expected.

FIGURE 1
PRETEST QUIZ RESULTS
n = 22

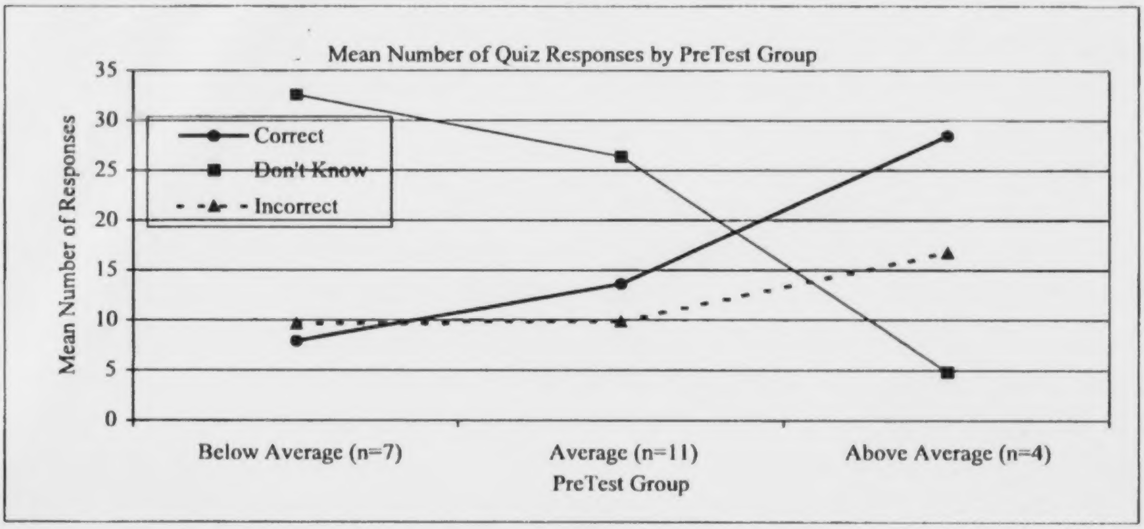
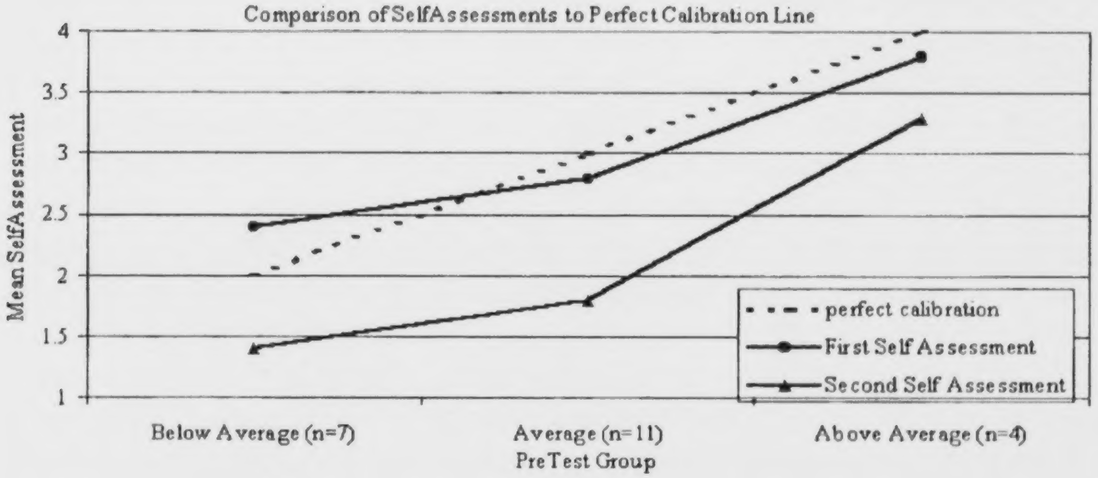


FIGURE 2
MISCALIBRATION AND RECALIBRATION IN THE PRETEST
n=22



At the end of the term, the posttest was administered and scores again plotted by pretest group. Overall, the class improved their quiz scores by an average of twelve questions; the range was two to twenty. As illustrated in Figure 3, though all groups improved their quiz scores, the below average group showed the greatest overall improvement, an average of fifteen questions.

What we had hoped to see, of course, was a difference in improvement between those who recalibrated on the pretest and those who did not. Figure 4 shows mean pretest, posttest, and improvement scores, based on correct responses to the quiz, grouped by whether recalibration occurred during the pretest. Those who recalibrated on the pretest had lower pretest scores, on average, than did those who failed to recalibrate. However, by the end of the course, there is virtually no difference in quiz scores between the two groups.

FIGURE 3
COMPARISON OF PRETEST AND POSTTEST QUIZ SCORES
n=22

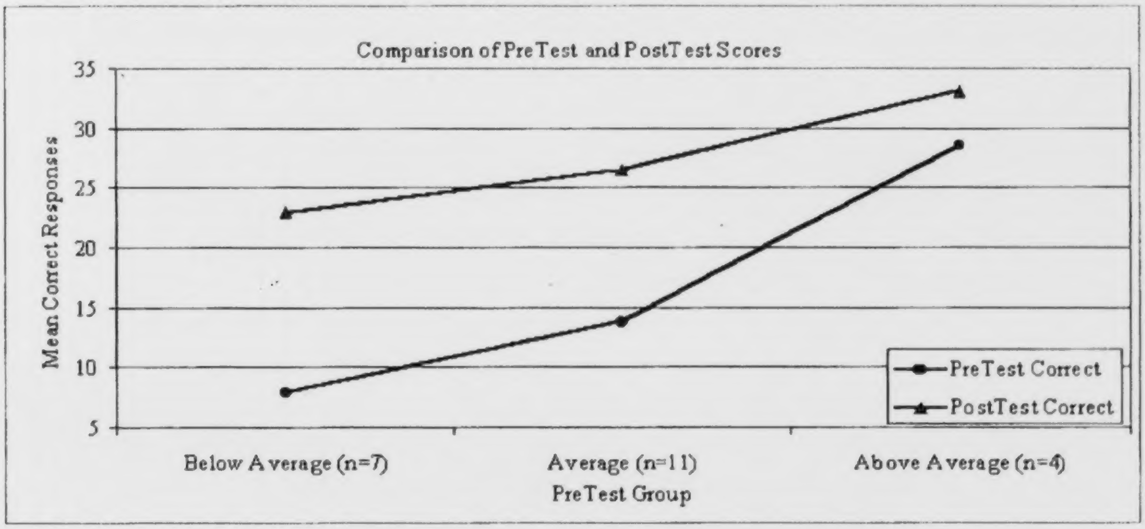


FIGURE 4
COMPARISON OF IMPROVEMENT BY RECALIBRATION GROUP
n = 22

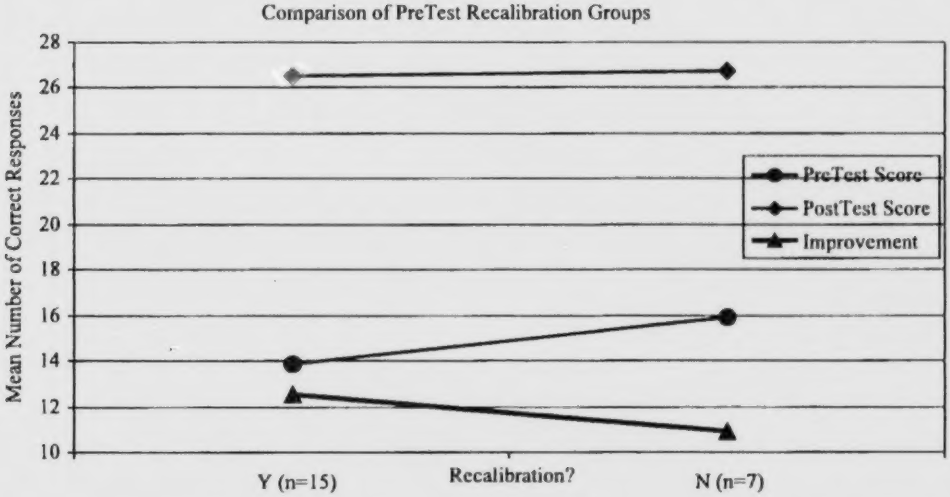
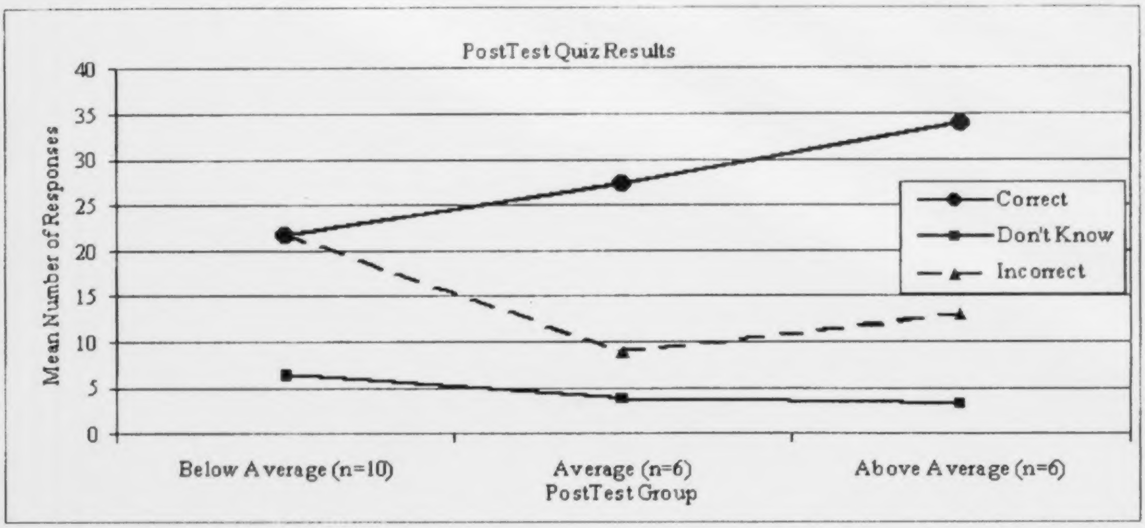


Figure 5
Posttest Quiz Results
n=22



Finally, posttest groups were formed in the same manner as pretest groups. Again, there were no students in either the far below or far above average groups. At the end of the course, ten students were below average, six average, and six above average. Figure 5 shows the mean number of correct, incorrect, and don't know responses for each posttest group. It is interesting to compare Figure 5 to Figure 1. Notice that the number of incorrect responses for the below average group is much higher on the posttest than on the pretest, more than double. At the same time, the number of don't know responses dropped for all groups.

DISCUSSION

Are any of these observations statistically significant? Unfortunately, errors in data collection resulted in our having fewer than half the observations we hoped to acquire over the course of the summer term. As a result, we do not have enough data at this time to do the analysis we had planned for this conference. We are, however, still collecting data and hope to present a more meaningful analysis in the near future.

Nonetheless, there are some encouraging observations to be made. Interestingly, and unexpectedly, recalibration seems to have occurred as a result of taking the multiple-choice quiz. It is difficult to explain why, in the absence of any feedback on actual performance, students would recalibrate in such a dramatic fashion. In the words of one author, "it looks like we scared 'em."

To confirm this, an analysis of the pretest data for the Fall 2000 term was performed to determine if what appears to be recalibration is merely a test-retest phenomenon. Because the first and second metacognitive instruments are not identical., the possibility of a test-retest problem seemed small. However, several students in the original study failed to complete the second metacognitive instrument, saying it was a duplicate of the first. (Those observations were subsequently discarded.) However, given the likelihood that participants perceive these two instruments to be the same, it seemed best to consider the possibility that what appears to be recalibration is nothing more than a test-retest problem.

Two different sections of the computer literacy course, taught by two different faculty members, were used for this analysis. In one section, the same instrument packet and protocol as were used in the Summer 2000 term were used; 34 complete observations were collected. In the second section, the multiple-choice quiz was replaced by a questionnaire asking students to provide some background information for the instructor. In addition, rather than receiving the second metacognitive instrument, which refers to pretest performance, these subjects were asked to complete a second copy of the first metacognitive instrument. A total of 31 complete observations were collected from the second class.

Recalibration scores were computed as the difference between the second self-assessment and the first. An ANOVA was performed to examine differences between first self-assessment, second self-assessment, and recalibration scores for the two classes. There was no significant difference in first self-assessment scores for the two groups; $p = 0.357$. However, both the second self-assessment and the recalibration means were significantly different; $p < 0.001$. In fact, 16 of the 34 participants who received the multiple-choice quiz recalibrated while none of the 31 participants in the other class changed their self-assessments.

The above analysis supports the idea that recalibration is occurring simply through exposure to course concepts on the multiple-choice quiz. In addition, faculty who have administered the quiz report that fewer students approach them about "testing out" of the course than in previous semesters. Although we cannot quantify this, it does support the idea that students adjust their expectations of course content or their self-assessments of course knowledge as a result of taking the quiz.

Second, either incorrect or don't know responses may provide an alternative measure of metacognitive miscalibration, perhaps eliminating the need for the metacognitive instruments. Looking at Figure 1 with this in mind, the above average group is more miscalibrated than the average and below average groups on the pretest. While the above average students clearly know more than their peers, they still scored very poorly on the pretest quiz; they do not know as much as they believe they do and, in this sense, are highly miscalibrated. By the time of the posttest, when all participants have been exposed to the same course material., the below average group is less well calibrated then the average and above average groups (Figure 5). This is consistent with claims that with domain competence comes the ability to make more accurate self-assessments; competence begets metacognitive (re)calibration.

Finally, while the study that triggered pursuit of this research (Kruger & Dunning, 1999) examined metacognitions at a micro level (judgments were solicited for each question), the current study takes a more macro approach (a single judgment for the entire body of knowledge). It is encouraging to see the same pattern of miscalibration coming from the macro approach as was seen in the micro approach.

CONCLUSIONS AND FUTURE RESEARCH

It is difficult to draw any meaningful conclusions from such a small data set. However, we do believe that instilling domain competence is not the only path to metacognitive recalibration. The comprehensive course pretest seems to be producing some recalibration, even without feedback on test performance. Only additional data, currently being collected, will tell if the recalibration is significant and whether recalibration leads to improved course performance.

The results we have seen thus far, combined with the informal observation that the pretest reduces the number of requests to "test out" of the course, reinforce our belief that course pretests are worthwhile. Furthermore, pretests make comparison of pretest and posttest performance possible, providing a source of encouragement and a measure of effectiveness for the faculty.

Plans for further study include several manipulations including providing feedback to students on pretest performance and providing compensation, in the form of bonus points, for both pretest and posttest performance. In addition, for the second round of data collection adjustments may be made to the multiple-choice quiz in order to raise the mean score and reduce the standard deviation, in an attempt to populate all five student groups.

REFERENCES

Alicke, M.D., Koltz, M.L., Breitenbecher, D.L., Yurak, T.J., and Vredenburg, D.S. (1995). Personal Contact, Individuation, and the Better-Than-Average Effect. *Journal of Personality and Social Psychology*, 68(5), 804-825.

Bjork, R.A. (1996). Memory and Metamemory Considerations in the Training of Human Beings. *Metacognition: Knowing About Knowing*, first MIT Press paperback edition, Metcalfe, J. & Shimamura, A.P., eds. Cambridge: MIT Press.

Dunning, D., Meyerowitz, J.A., & Holzberg, A.D. (1989). Ambiguity and Self-Evaluation: The Role of Idiosyncratic Trait Definitions in Self-Serving Assessments of Ability. *Journal of Personality and Social Psychology*, 57(6), 1082-1090.

Kruger, J. & Dunning, D. (1999). Unskilled and Unaware of It: How Difficulties in Recognizing One's Own incompetence Lead to Inflated Self-Assessments. *Journal of Personality and Social Psychology*, 77 (6), 1121-1134.

Maki, R.H., Jonas, D., & Kallod, M. (1994). The Relationship Between Comprehension and Metacomprehension Ability. *Psychonomic Bulletin & Review*, 1(1), 126-129.

Metcalfe, J. (1998). Cognitive Optimism: Self-Deception or Memory-Based Processing Heuristics? *Personality and Social Psychology Review*, 2(2), 100-110.

Metcalfe, J., Schwartz, B.L., & Joaquim, S. G. (1993). The Cue-Familiarity Heuristic in Metacognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19(4), 851-860.

Shaughnessy, J.J. (1979). Confidence-Judgment Accuracy as a Predictor of Test Performance. *Journal of Research in Personality*, 13(4), 505-514.

Sinkavich, F.J. (1995). Performance and Metamemory: Do Students Know What They Don't Know? *Journal of Instructional Psychology*, 22(1), 77-86.

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KNOWLEDGE DISCOVERY IN DATABASE TECHNIQUES APPLIED TO STUDENTS RECRUITMENT SYSTEMS IN UNIVERSITIES

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ABSTRACT

This paper will introduce the knowledge discovery in database (KDD) process applied to the students recruitment systems in universities. The definition of the KDD process and its importance will be defined. Different terminology for the knowledge discovery process will be discussed with particular emphasis on data mining. The distinction between KDD and data mining will be clarified by showing the place of the data mining in the KDD process. The tasks and goals data mining are illustrated. The different data mining techniques will be discussed. To place the entire KDD process in context, it is applied to a sample data set of 1600 records drawn from the Arab Academy for Science & Technology and Maritime Transport (AASTMT).

THE EMERGENCE AND DEFINITION OF THE KDD PROCESS

The term KDD was coined in 1989 to point to the process of finding knowledge in data. KDD is defined as the process of finding patterns hidden information or unknown facts in the database (Fayyad, et al., 1996). Traditionally the notion of finding useful unknown patterns and hidden information in raw data has been given many titles including knowledge discovery in database, data mining, data archaeology, information discovery, knowledge discovery or extraction, and information harvesting (Adriaans and Zantinge, 1996). The reasons for this lack of consensus are the novelty of the KDD and the multi-disciplinary features of KDD. Multi-disciplinary means that KDD belongs to many disciplines like statistics and computer (machine learning, artificial intelligence (AI), databases, data warehousing, expert systems, knowledge acquisition and data visualization), from which the KDD process was drawn (Fayyad, et al., 1996). It is this broad applicability that has led number of researchers and scholars to have common interest in KDD.

The interest in KDD has been increased and this is demonstrated by the increasing number of forums and workshops. Another sources of interest are the various publications and special issues that document some of the KDD features and foundations (Inmon & Osterfelt 1991). Although, the field of KDD was founded on many disciplines, however, it is gaining its character on its own and now stands by itself (Ramakrishnan and Grama, 1999).

KDD OR DATA MINING

Scientists have used the two terms KDD and data mining interchangeably (Ganti, et al., 1999). However, others said that data mining is a step in the KDD process (Adriaans and Zantinge, 1996). For the purpose of this paper data mining is considered a step in the KDD process. In other words, KDD is an overall process of discovering useful knowledge from data, whilst data mining points to the application algorithm or technique used for extracting patters and unknown information from the raw data. So the KDD process will get knowledge from the data mining techniques applied to a certain application.

THE KDD PROCESS

The KDD process is interactive, iterative, and involves a great deal of user-interference. Brachman and Anand (1996) defined the practical view of the KDD:

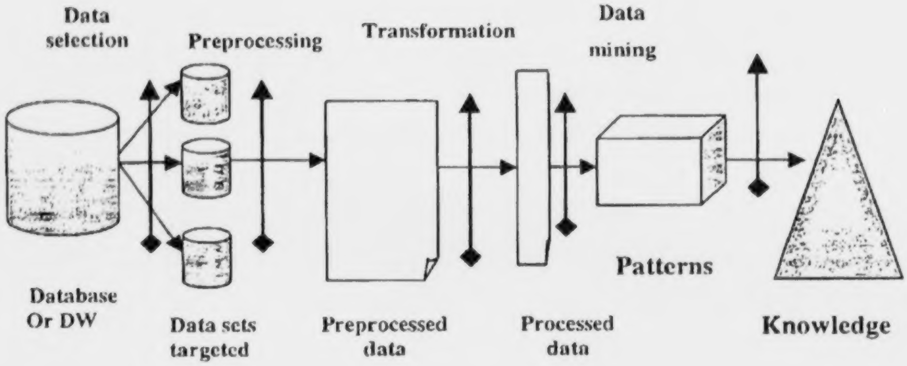
1. *Developing an understanding of the application domain.* This is an important step because it determines and the goals of the KDD application. Based on these goals the relevant data mining techniques can be employed, where there is no one single technique best fits all sources of application domains;
2. *Creating a target data set.* Selecting the data set, or focusing on a subset of the database on which discovery will take place;
3. *Data cleaning and preprocessing.* Basic operations such as the removal of noise if relevant, and deciding on the strategy of how to deal with missing data items. Example of strategies that might be used here are neglecting the incomplete data records or setting missing values to null;
4. *Data reduction and projection.* Finding useful features to represent the data set depending on the goal of the task. For example if the goal of the KDD task is to determine and predict the students' academic performance, not all of the student's record is of importance. Examples are the students' address, telephone number or height and weight;
5. *Choosing the data mining task.* This is an important step in which the goal of the KDD process is defined as weather classification, clustering, summarization or others;
6. *Choosing the data mining technique(s) or algorithm(s).* Selecting the methods to be used for searching in the data for patterns and hidden information. There should be a match between the goal of the KDD and the data mining techniques or algorithms;
7. *Data miming.* Searching for patterns in the data sets using analysis methods and models such as regression, clustering, SQL, visualization, decision trees and others;
8. *Interpreting the information gained by the mining techniques.* The output of the mining techniques should be evaluated to be understandable and consistent. Iterations from steps 1 to 7 may also happen when apply KDD to real problem;
9. *Consolidating the discovered knowledge.* Reporting the knowledge to the interested parties and checking the discovered knowledge with the previously known knowledge.

During the KDD process, particularly the data mining step, it is necessary to search the database of the organisation. When the organisation database(s) contain history of data for years it is said to be data warehouse (DW). When the DW contains all organisational data it is called enterprise DW, whilst if the DW contains functional data about marketing, personnel, or production it is said to be a data mart. The data warehouse (DW) will enhance the KDD results (Taha, et. al., 1997; Berson and Smith, 1997; Barquin, 1997; Paller, 1997). So, data warehouse will enhance the KDD process through the wealth of historical data it offers to the mining techniques (Berson and Smith, 1997; Adriaans and Zanting, 1996). the discovered knowledge should be utilized in a suitable front-end tool like executive information systems (EIS) or decision support systems (DSS). The following Figure 1 describes the whole KDD process.

THE PRIMARY TASKS OF DATA MINING

The two high-level fundamental goals of data mining in practice are prediction and description (Fayyad, et al., 1996). Prediction is the use of some variables or data fields in the database to predict the unknown future values of the other variables or data fields of interest. Description focuses on finding human understandable patterns describing the data set. The relative necessity of both of these goals varies from application to another. Both goal prediction and description are achieved using the following data mining tasks.

FIGURE 1
THE KDD PROCESS OVERVIEW



1. *Classification.* It is a learning function that classifies a data into one of several predefined classes; Example is found in classifying students concerning the scholarship the university grants into granted and not-granted, based on GPA (grade point average);

2. *Regression.* A regression model is a mathematical equation that provides predictions of the values of one variable (dependent) based on the known values of one or more other variables (independent). If one predictor is considered then the regression is called simple linear regression, if more then the regression is called multiple linear regression (Canavos and Miller, 1995);

3. *Clustering.* Clustering is the process of producing classifications from initially unclassified data (Everitt, 1981). It is a common descriptive task where one seeks to identify a finite set of categories or clusters to describe the data;

4. *Summarization.* The process of finding a compact description for a subset of data. Examples of summarization like finding the mean and standard deviation of all data fields of interest, or the discovery of the relationships between variables;

5. *Change and deviation detection.* It focuses on discovering the most significant changes in the data from previously measured or normative values.

DISCUSSION OF COMMON DATA MINING TECHNIQUES

Any form that would help extracting more patterns and hidden information from the database is called a data mining technique (Adriaans and Zantinge, 1996). Many classifications are found for data mining techniques based on many variant factors of classification (Ramakrishnan and Grama, 1999), like:

1. *The induced representation* (decision trees, rules, correlations, deviations, trends, and associations);

2. *The data they operate on* (time series, discrete, labelled, continuous, or nominal);

3. *The application domains* (finance, economic, biology, Web log mining and the like).

Another said that the data mining techniques are many (Adriaans and Zantinge, 1996), these are; Query tools, Visualization, On-line analytical processing (OLAP), Association rules, Case-based learning (nearest neighbour), Decision trees, Statistical techniques, Genetic algorithms (GA), and Artificial neural networks (ANN). Discussions of the techniques that are of interest to this research are developed in the following sections.

Query Tools

Traditional query tools are first used to analyze the data sets. By applying simple structured query language (SQL) we can obtain a wealth of information. However, before we can apply more advanced pattern analysis algorithms, we need to know some basic aspects and structures of the data set. With SQL we can uncover only shallow knowledge that is easily accessible from the data set: yet although we cannot find hidden knowledge. Adriaans and Zantinge (1996) said,

> *for the most part 80% of the interesting information can be abstracted from a database using SQL. The remaining 20% of hidden requires more advanced techniques.*

However, for most organizations this 20% of the hidden knowledge have 80% of the importance in relation to decision making, and the 80% information volume represent only 20% in terms of value to the decision making process. A good way to start is to extract some simple statistical information from the data using SQL queries. For example:

- How many students in the university taking the accounting major?
- What is the average GPA for the male students with an American diploma background?
- How many grants go to junior students?
- What is the nationality distribution of students?

Decisions could be taken based on the output of the SQL statements.

Visualization

Visualization technique depends strongly on the human side of the analysis (Berson, 1996). Even the best set of rules or tables of data may reveal more information when visualized with color, relief, or texture in *2D*, *3D* and even *4D* representations. In the 4D, 3D are mapped onto the screen and the fourth can be expressed through the use of color (Berson and Smith, 1997). Visualization technique may be used throughout the data exploration process and are particularly useful during the initial stages of the high-level groupings of data sets. An elementary technique that can be of great value is the *scatter diagram*; in which information on two attributes is displayed in a Cartesian space. Scatter diagrams can be used to identify interesting sub-sets of the data sets so that we can focus on the rest of the data mining process (Adriaans & Zantinge, 1996).

Data visualization is emerging as an advanced technology that may allow organizations to process amounts of information and present it in a usable format. Through the interface visualization techniques provide the non-computer users to navigate through data using their human feelings of the data displayed. Visualization technique plays a great role, that is it puts the information we have in an easy and understandable way for both computer and non-computer aware people (Keim, et al., 1996). The following benefits are earned beyond the use of visualization techniques (Berson, 1996):

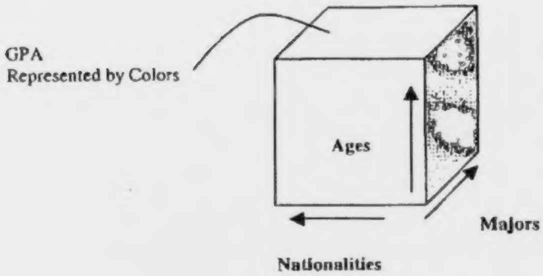
- Users can easily interact with attributes and illustrate how they affect certain phenomenon;
- Users can view summarized data with drill down capability;
- Find hidden patterns;
- It is considered an exploratory data analysis tool (EDA). That is data navigation, comparison, scaling, filtering are available to users.

On Line Analytical Processing (OLAP) Tools

The need for OLAP was developed to handle situations where the relational database management systems (RDBMS) can not deal with *the multidimensional* problems. Although RDBMS are powerful solutions for a wide range of commercial and scientific applications, they are not good at addressing the modern business analysis, forecasting, and all the like that are multidimensional in nature (Berson, 1996). The key driver for OLAP is the multi-dimensional nature of the issues it deals with. For example managers might ask question like the following: Describe the relationship between majors, nationalities, ages, and GPA?

OLAP is a continuos and iterative process, an analyst may drill down to see much more details. And this discovery of knowledge forces the managers to ask more complex questions. Multidimensionality is the core of a number of OLAP systems available. OLAP involves several basic analytical operations including consolidation, drill-down, and statistical techniques (O'Brien, 1996).

FIGURE 2
OLAP EXAMPLE



1. *Consolidation.* Consolidation involves the aggregation of data, i.e. the total number of students at the university, total courses, and average GPA;

2. *Drill-down.* This is the opposite of consolidation that involves more details;

3. *Slicing and dicing.* Slicing and dicing refers to the ability to look at the database from different viewpoints.

Association Rules

Association rules are always defined on binary attributes. This sort of attributes makes it easy to describe the student profiles in our example database. Example is: *Male student, Nautical department→Egyptian nationality*. This means that if the student 's gender is male and the major is nautical, so the student's nationality is Egyptian. And this happening 65% confidence level.

In fact, the number on possible association rules that might be found in a database is almost infinite. Some roles are found to be useless (Argawal, et al., 1996). The level of *Confidence* is a mechanism used eliminates useless rules, with low confidence levels. Confidence is the percentage of records that holds true for the fact under studying within the group of records.

Decision Trees and Rules

A decision tree is a predictive model that can be viewed as a tree. Each branch of the tree is a classification question, and the leaves are partitions of the data set with their classification (Berson and Smith, 1997). Another definition for the decision tree uses logical methods of describing regions of state. These logical methods could be interpreted in a "IF..THEN" rules space (Pyle, 1999). One variable is studied individually in a decision tree. The start point is found when the variable that best classifies the state space is determined and consequently the true state is also raised. The algorithm of the tree then looks for another classifying variable and another splitting rule. This process continues until some ending criteria is found. Another algorithm for developing the decision tree is called ID3 is iterative algorithm. The ID3 start with a subset of the data called *window*. The window is chosen at random and then develops the tree which is correctly classifies the subset into branches. Then all other data are classified using the tree. If each data record finds its classification so the process terminates. If not, a selection of the incorrectly classified data records is added to the window and the process continues (Quinlan, 1986).

The decision tree is a useful technique in both data mining and predictive modelling processes. It prevents the problems of overfitting (it happens when the algorithm searches in the limited data sets, so the algorithm might overfit the data) and handling of missing data that majority of the mining techniques always leave these problem in the user side. The decision tree classifies the data into branches without loosing any of the data records.

Artificial Neural Networks (ANN)

The term artificial neural networks (ANN) is a computer programs that implements complex pattern detection and machine learning algorithms to build predictive models from large database(s). In order for the ANN to detect patterns in the data sets, it should learn to detect these patterns and make predictions, is the same like a human being does. ANN are widely used in many business applications. Most of the ANN are hard for users to understand because they lack clarity, however, vendors tend to introduce the ANN in visualization formats that make them understandable. Also an ANN is a time consuming process to build, however, it is a very powerful predictive technique that require some data preprocessing, good understanding of the problem and the target of prediction. It also requires the setting of some parameters that will drive its mission (Berson and Smith, 1997).

Nearest Neighbour

Nearest neighbour is a prediction technique that is used to perform data *clustering*. Many other techniques are used for clustering *like the complete linkage method or the furthest neighbour, Centroid cluster analysis, Media analysis, Group average method*, and *automatic interaction detection* (Everitt, 1981). Since they all perform the same job, which is data classification or data clustering, one of them is illustrated here.

It begins with a distance *matrix* that shows the individual groups and end with a *dendrogram* showing the successive fusions which culminates all individuals in one group (Everitt, 1981). Groups of single individuals are fused with their nearest members. Each fusion decreases by one the number of groups. The concept of nearest neighbour states that records that are close to each other live in each other's neighbour. For example, if we need to predict the performance of a student we first look at the students that are lose to him in the database.

Nearest neighbour is used in many business applications like bankruptcy prediction in the banking industry and handwriting recognition. The nearest neighbour technique is automated but require some preprocessing of data in converting some predictions into values that will be used to measure distance. However, unordered variables like eye-color should be transformed into the distance between each other when there is a match found (Berson and Smith, 1997). The techniques will give the user the high-level view of what is going in the database. The nearest neighbour is optimized for prediction of new records rather than exhaustive extraction of interesting rules from the database. Most of the text retrieval systems are built around the nearest neighbour technologies. A problem in the nearest neighbour is the existence of tables consists of high number of attributes. Nearest neighbour does not perform well if there is a very big number of independent attributes because this will need a multi-dimensional search space. Possible problems associated are millions of very complex and it is also possible to find an equal space between data that is hard to define the nearest of them. One approach here is to limit the number of attributes by finding the relative importance of them and work on them, or to search for another technique that is able to handle the large number of attributes.

Genetic Algorithms

This term is a combination of both biology and computer disciplines, and sometimes referred to as simulated evolution. Berson and Smith (1997) said "Genetic algorithms loosely refer to these simulated evolutionary systems, but more precisely these are the algorithms that dictate how populations of organisms should be formed, evaluated and modified". Genetic algorithms are used to create the biological evolution version of computers. They start on a small program and then mature themselves as the human organisms undergoing natural evolution. Over time, these programs on the computer improve in their performance and as a result increase the efficiency of resolving a certain problem. In many ways genetic algorithms are close to the biological evolution, the analogy is like Table 1.

Genetic algorithms are used to find optimal clusters based on a defined profit measure. They have been used to optimize the nearest neighbour classification systems for predicting sequences in time series (Berson and Smith, 1997).

Probabilistic Graphical Dependency Technique

These models specify the probabilistic dependencies, which underlie a particular model using a graphical structure. The model specifies which variables are dependent on each other. These models are used for categorical or discrete-valued variables, however, some extensions allowed the use for real-valued variables also. Within artificial intelligence and statistics these models are initially built in the context of the probabilistic expert systems (ES). Although, graphical models induction is still not a mature discipline, it is of interest to the KDD applications since graphical forms of the model are easily understood by users (Fayyad et al., 1996).

EXAMPLE FOR THE KDD PROCESS APPLIED TO STUDENT RECRUITMENT SYSTEMS

The KDD process will be applied to a sample data records (1600 records) extracted from the students' recruitment system database used at AASTMT.[1] Not all of the database fields were used for this purpose; rather the data, which are of importance to the executive managers that, are entailed in the students' recruitment system functions.

TABLE 1
GENETIC ALGORITHMS AND BIOLOGY

Biology	**Genetic Algorithms**
-Organism	Which is the computer program being optimized
-Population	The collection of programs undergoing simulated evolution
-Chromosome	The chromosome encodes the computer program
-Fitness	The calculation with which a program value is determined for survival of the fittest
-Gene	The basic building block of the chromosome that defines one particular feature of the simulated organism
-Locus	The location of the chromosome that contains a specific gene
-Allele	The value of the gene
-Mutation	The random change of the value of the gene
-Mating	The process by which two simulated programs swap pieces of them in a simulated crossover
-Selection	The best program is retained and the less successful are excluded by deleting them from computer memory.

Data Selection

In the sample under study, 1600 records of the applicants, from which a number of 1100 has been accepted at AASTMT (AASTMT application records, 1995; AASTMT statistics, 1995). The records consist of serial number, application number, first name, nationality, sex, address, desire(s), percentage grade, accepted/rejected, and department. In order to facilitate the KDD process a copy of this operational data was drawn and stored separately, sample records of this database is given here in Table 2.

Cleaning

Several methods are available to clean the data i.e. remove errors. Some of these methods can be executed in advance while others are only invoked after errors are detected at the coding or the discovery stage (Adriaans & Zantinge,1996). A very important element in a cleaning operation is the *de-duplication* of records (Table 3). In the student database file one student may be presented by more than one record. For example, if a student applied from abroad and then a relative also applied on behalf of the student, this should be positioned another application for the same person, this would be clear from the check of data. Another source of error is that students change their address without notifying the Admission & Registration office. There are also cases in which people spell their names incorrectly or give incorrect information about themselves by slightly misspelling their name or by giving a false address. Data cleaning processes affect the quality of the mining process, because as much seriously the process of data cleaning was performed, the results of data mining would be helpful and trustworthy.

In the present example we have two different records for the same student data, so this may be due to two persons submitted the same student data without the student being aware of that. Of course, we can never be sure of this, but de-duplication algorithm using analysis techniques could identity the situation and present it to a user to make a decision. The second type of data errors that frequently occurs *is the lack of domain consistency*, (Table 4).

In Table 4 the first student department is empty, however, this attribute should have a value. Empty values are a source of problems to the data mining process, because this might affect the type of patters discovered. If the data item is not defined it should be NULL. On the second record there is inconsistency in the domain of nationalities and cities, the opposite is true; replacement would happen between city, and nation. The result is shown in Table 5.

Enrichment

Assume that we have got some extra information about the students' family annual income, and the student secondary school, where it is possible to get or buying them. See Table 6.

Coding (Pre-coded data)

In the next stage, we select only those records that have enough information to be of value. Notice that the extra information should be added to the original data. See Table 7.

A general rule states that any deletion of data must be a conscious decision, after a thorough analysis of the possible consequences. However, in some cases lack of information can be a valuable indication of interesting patterns. In the presented cases in Table 7 for the students Tarek, and Wael, we lack some vital data concerning them, so we choose to exclude their records from the final sample. Of course, this decision is questionable, because there may be a causal connection; however, it is better to delete incomplete information instead of getting incorrect results (Adriaans and Zantnige, 1996). Next we carry out a projection of the records. In our example we are not interested in the students' name, so their names are removed from the sample. Up to this point, the coding phase consisted of nothing more than simple SQL operations but now we are entering the stage where we will be able to perform some data transformations.

Coding (Post-coding Data)

Coding is a creative activity that has to be performed repeatedly in order to get the best results. Income even is a source of problem. One solution might be to transform income into categories and describe each category's characteristics. For example: annual income between 300.000-200.000 L.E is called moderate-and coded 01, and annual income between 1,000,000-2,000,000 L.E is called premium income-and coded 05. *So that we can obtain information such as the following:*

1. Students applied from nationality Egyptian, in the Maritime department, have a premium income group. OR
2. Students from Syria, always have Engineering as a major, with average marks of 60%.

Instead of doing a student data analysis, the relationships between students of different nationalities are important. This means that we will not be investigating the connections between individual attributes, but between different student profiles. Before going in depth to the results, a complete coding process should take place.

Table 8 represents the new table that results from the coding process. A table in this format is not very helpful if we need to find relationships between different student profiles. Each student is represented by one record. That is, instead of having one attribute with five different possible values, we create twenty binary (*0 and 1 are the components of the code*) attributes, one for each nationality. If the value of the nationality attribute is "10" this means that the student is Egyptian, 20 means Sudanese, 30 means Libyan etc. Such an operation is called (*Flattening)* an attribute with *cardinality n* is replaced by *n* binary attributes. Applying the concept Flattening to the Sex results in 01, 02, which means that male is replaced by 01, and female is replaced by 02 (*cardinality 2)*.

Data Mining Techniques

The data mining techniques were discussed with respect to many classification mechanisms, however, the KDD example here will not definitely handle all of the techniques because there is no single application that uses all of the data mining techniques, and that is due to the differences between techniques and data sets and the application domains.

Traditional query tools

A good way to start is to extract some simple statistical information from the data set. *Table 9 provides statistics on students.*

TABLE 2
SAMPLE OF THE ORIGINAL DATA

SN	App. No	F.Name	Sex	Nation	City	Desire	% mark	A/R	Dept
1	697	Mary	F	Egy	Alex	Hot	95	A	Hot
4	1079	Asser	M	Egy	Alex	Bus	70	A	Hot
197	1484	Ismael	M	Syr	Dam	Eng	67	A	Eng
1	1570	Mohamed	M	Egy	Alex	Hot	90	R	
4	19	Lamees	F	Pal	Dub	Bus	83	R	

Note: SN stands for serial number, App.No for application number, F.Name for first name, Nation for nationality, A for accepted & R for rejected, and dept for department. Also, the departments, and nationality names have been curtailed for space purpose in the table.

TABLE 3
DE-DUPLICATION OF RECORDS

SN	App. No	Name	Sex	Nation	City	Desire	% mark	A/R	Dept
270	316	Ehab	M	Egy	Alex	Eng	70	A	Eng
271	623	Ehab	M	Egy	Alex	Eng	70	A	Eng

TABLE 4
DOMAIN CONSISTENCY

SN	App. No	Name	Sex	Nation	City	Desire	% mark	A/R	Dept
541	350	Ahmed	M	Egy	Cairo	Eng	70	A	
215	476	Ahmed	M	Alex	Lyb	Eng	70	A	Eng

TABLE 5
DOMAIN CONSISTENCY-1

SN	App. No	Name	Sex	Nation	City	Desire	% mark	A/R	Dept
541	350	Ahmed	M	Egy	Cairo	Eng	70	A	NULL
215	476	Ahmed	M	Lyb	Alex	Eng	70	A	Eng

TABLE 6
ENRICHMENT

SN	App. No	Name	Income	School	Nation	Dept
100	801	Ola	200.000	Saudi Sch.	Sau	NULL
200	802	Alaa	350000	IGCSE	Leb	Eng

TABLE 7
ENRICHED TABLE

SN	App. No	Name	Inc.	Car	Sex	Nation	City	Desire	%	A/R	Dept
911	350	Tarek	Null	Null	M	Egy	cairo	Eng	60	A	Null
111	714	Wael	150	Null	M	Null	Alex	Mar	85	A	Eng

TABLE 8
THE CODING EFFECT

SN	App. No	Inc.	Car	Sex	Nation	City	Desire	%	A/R	Dept
911	350	05	Null	M	10	101	1	60	A	1
111	714	01	Null	M	30	301	4	85	A	4

TABLE 9
STATISTICS

Department	Private*	Sponsor**	Transfer	Total
Nautical	54	6	0	**60**
Maritime Eng.	37	2	0	**39**
Mechanical Eng.	51	0	2	**53**
Computer Eng.	93	6	6	**105**
Power Eng.	64	0	0	**64**
Electronics Eng.	78	5	5	**88**
Construction Eng.	61	0	0	**61**
Managerial Eng.	58	0	0	**58**
Business Adm.	181	6	7	**194**
Hotels & tourism	27	0	1	**28**
Grand total	**704**	**25**	**21**	**750**

* **Private** private student means that he/she pays for himself/herself.

** **Sponsor** sponsored student appears when a certain agency pays for the student fees and accommodation, regardless of the reason.

A number of 350 students should be added to the grand total of the previous table"1100 total accepted", they represent the number of students that will join the preparatory program so that, after succeeding they can join the next semester unless rejected. From table (9), and the original data sets, a lot of shallow knowledge can be extracted and represented. For examples, the percentage of sponsored students at the AASTMT- according to the sample data records- is about 3%, as well as the transfer students "*if the AASTMT has 1000 students 940 are predicted to be private, 30 are transfer, and 30 are sponsored*". The analysis is not a goal in itself, rather the implications of the analysis to the executive who will take a decision according to that analysis. For example, the drill down capability reveals that the 3% of students who are sponsored historically joined the Nautical department which has a little demand nowadays (AASTMT statistics, 1990-1997). May be the reason is the student is actually sponsored but he claims the opposite to save money, this is because sponsored students pay higher fees. Also, the fact that the Business Administration has the highest demand may be traced and mined as follows:

- Maybe the competitor universities are weak in this field.
- Maybe the excellent facilities the AASTMT has made this possible.
- Maybe the staff members of the Business Administration department are superior to its rivals, and use nice textbooks.

No matter what the reason is the analytical ability offer the different possibilities to the executives and find the hidden knowledge and patterns, then the role of the executive is to take corrective actions.

Visualization Techniques

In Figure 3, visualization technique plays a great role, that is it puts the information we have in an easy to understand way. Table 9 has been transformed to the Figure 3.

OLAP

We can plot Table 9 in the following format in Figure 5. The figure represents the students' data against departments, regarding if they are sponsored, private, or transfer students, but in a category of details level.

Association Rules

For the purpose of our database set we can develop a set of rules. For example: **93% of the students taking the Bus. Adm. major→25% of total students**. The previous rule importance is that, what is applied to the private students at the Business Administration department is applied to 25% of the total private students.

Decision Trees and Rules

A decision tree like the following can be found in the admission and registration function.

FIGURE 3
VISUALIZING NEW KNOWLEDGE

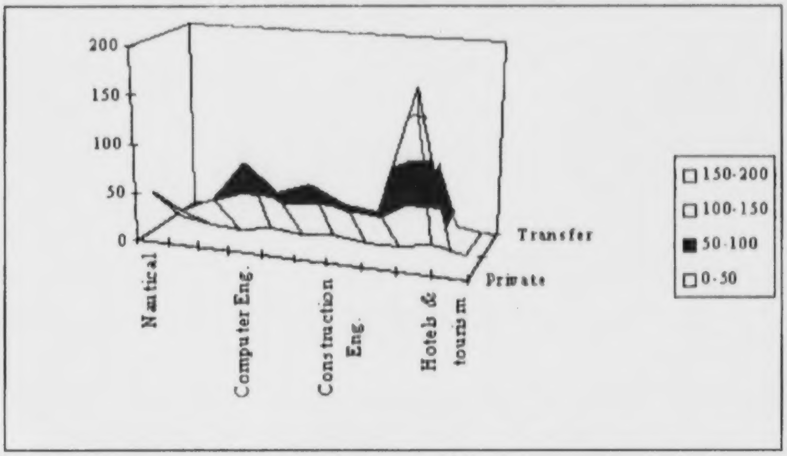


FIGURE 4
SLICING AND DICING

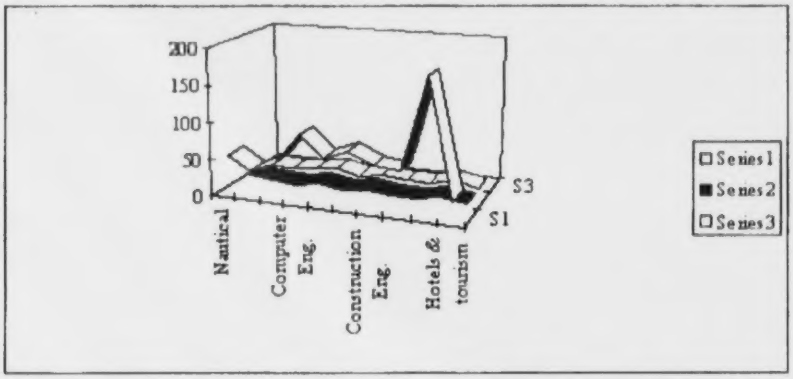
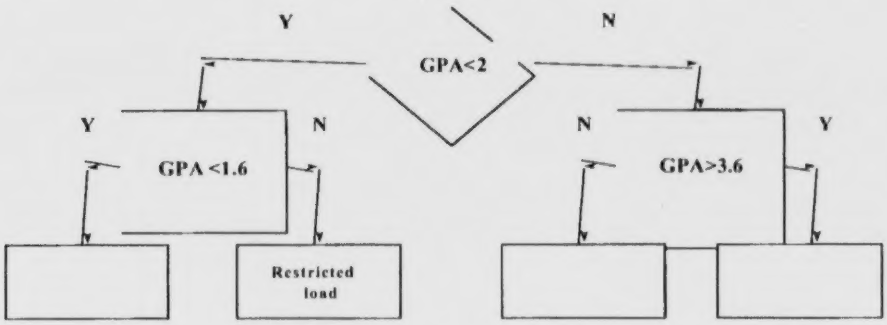


FIGURE 5
DECISION TREE FOR STUDENTS'GRANTS



- The example follows the credit hours system at the AASTMT.

Rule 1: IF GPA is less than 1.6 THEN student is on probation.
Rule 2: IF 1.6 is less than or equal GPA is less than 2THEN student has restricted load.
Rule 3: IF 2 is less than or equal GPA is less than 3.6 THEN student takes award.
Rule 4: IF 3.6 is less than or equal GPA is less than or equal 4 THEN student takes grant.

Nearest Neighbour

Assume that we have 4 student GPA groups. As in the following matrix:

FIGURE 6
DENDROGRAM

$$\text{Matrix G1=}\quad \begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 3.2 & 3.4 & 3.8 \\ 2 & 3.2 & 0 & 4 & 2 \\ 3 & 3.4 & 4 & 0 & 1.9 \\ 4 & 3.8 & 2 & 1.9 & 0 \end{array}$$

Step (1): The smallest entry is G34, so group 3 and 4 are fused together. Distance between G34 and groups 1 and 2 :

$G(34)1=\min\{G31,G41\}=G31=3.4$

$G(34)2 = \min\{G32,G42\}=G42=2$

Step (2): Matrix G2 is the following.

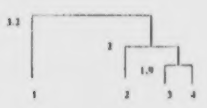
$$\text{Matrix G2=}\quad \begin{array}{c|ccc} & 1 & 2 & (34) \\ \hline 1 & 0 & 3.2 & 3.4 \\ 2 & 3.2 & 0 & 2 \\ (34) & 3.4 & 2 & 0 \end{array}$$

The smallest entry is G2(34), so group 2 and (34) are fused together. Distance between G2(34) and group 1:

$G(34)1=\min\{G31,G41\}=G31=3.4$

$$\text{Matrix G3=}\quad \begin{array}{c|cc} & 1 & 2(34) \\ \hline 1 & 0 & 3.2 \\ 2(34) & 3.2 & 0 \end{array}$$

The dendrogram is the following.



Reporting

Reporting the results of data mining can take many forms. *In general, one can use any report writer or graphical tool to make the results of the process accessible* (Adriaans and Zantinge, 1996). For some applications, like the students' recruitment system the reports might be connected to an EIS or a DSS (Taha, et.al, 1997). It has been found that the interactive character of the KDD process leads to the consistent interplay between the selection of data, cleaning, data mining, and the reporting results.

KDD FUTURE RESEARCH

- *larger databases/algorithm scalability and dimensionality*. The mining techniques as step in the KDD process should be able to handle database with hundreds of tables and fields, as well as with millions of records. This may cause induction and time problems.

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- *overfitting*. This happens when the mining algorithm searches for the best parameter for one model using a limited data set.

- *changing data and knowledge*. Rapidly changing data may cause the discovered patterns to be irrelevant and spurious. Example is the stock market data.

- *missing and noisy data*. Here the problem emerges when important data items are missing. This problem often occurs when the database design is carried out without taking into consideration the discovery process.

- *understandability of discovered knowledge*. One critical factor in KDD applications is to make the output of the systems human-understandable.

- *data security*. This is related to the security of the original data and how should the mining techniques deal with this data without violating their security.

CONCLUSION

KDD is the process of fining hidden knowledge, patterns and unknown facts from the data sets. KDD is an entire process starting with selecting the application domain ending with the output knowledge, which needs a suitable front-end tool. The front-end might be EIS, or DSS. Data mining is a step in the KDD process. The output knowledge of the KDD process will enhance the decision quality. The data mining techniques can be applied to the students' recruitment systems at universities.

ENDNOTE

1. Data used with permission.

REFERENCES

Arab Academy for Science and Technology & Maritime Transport (AASTMT) statistics. Different volumes from 1990-1997.

Adriaans, P., and Dolf Zantinge. (1996). Data Mining, Addison Wesley Longman.

Agrawal, R., Mannila, H., Srikant, R., Toivonen, H., and Verkamo, A. (1996). Fast discovery of association rules. In Fayyad, U., Piatetsky, G., and Padharic Smyth. Advances in Knowledge discovery and Data Mining. AAAI Press/ The MIT Press.

Agrawal, S., Agrawal, R., Deshpande, P., Gupta, A., Naughton, J., Ramakrishnan, and Sunita Sarawagi. (1996). On the Computation of Multidimensional Aggregates. In Proceedings of the 22nd VLDB Conference Mumbay, India, 1996.

Anand, S., Bell, D., and J. Hughes. (1995). Evidence based discovery of knowledge in databases. In Colloquium on Knowledge Discovery in Databases, IEE, UK, pp. 9/1-9/4.

Barquin, R. (1997). A Data Warehousing Manifesto. Planning and Designing The Data Warehouse, Prentice Hall, pp.3-16.

Barquin, R., Paller, A., and Herb Edelstein (1997). Ten mistakes to avoid for data warehousing managers. Planning and Designing The Data Warehouse, Prentice Hall, pp.145-156.

Berson, A. (1996). Client/Server Architecture, McGraw-Hill.

Berson, A., and Stephen Smith. (1997). Data Warehousing, Data Mining, & OLAP, McGraw-Hill.

Brachman, R., and Tej Anand. (1996). The process of Knowledge Discovery in databases. In Fayyad, U., Piatetsky, G., and Padharic Smyth. Advances in Knowledge discovery and Data Mining. AAAI Press/ The MIT Press, pp.37-57.

Canavos, G., and Don M. Miller, (1995). Modern Business Statistics, Duxbury.

Chen, M., Han, J., and Philip S. Yu. (1996). Data Mining: and overview from a database perspective. IEEE Knowledge and Data Engineering, (8:6)pp.866-883.

David, W., Vitcent, T., Ada, W., and Yongjian, Fu (1996). Efficient Mining of Association Rules in Distributed Database. IEEE Knowledge and Data Engineering, (8:6) pp. 911-922.

Edelstein, H. (1997). An introduction to data warehousing. Planning and Designing The Data Warehouse, Prentice Hall, pp.31-50.

Everitt, R. (1981). Cluster analysis, Halsted press.

Fayyad, U., Piatetsky, G., and Padharic Smyth, (1996). From Data Mining to Knowledge Discovery: An Overview. In Fayyad, U., Piatetsky, G., and Padharic Smyth. Advances in Knowledge discovery and Data Mining. AAAI Press/ The MIT Press, pp. 1-34.

Gaines, B. (1996). Transforming Rules and Trees. In Fayyad, U., Piatetsky, G., and Padharic Smyth. Advances in Knowledge discovery and Data Mining. AAAI Press/ The MIT Press, pp.205-220.

Ganti, V., Gehrke, J., and Raghu Ramakrishnan (1999). Mining very large databases. IEEE Computer magazine, Aug 1999,pp.37-45.

Garcia-Molina, H., Labio, W., and Jun Yang. (1998). Expiring Data in a Warehouse. In the Proceedings of the 24th VLDB Conference, New York, USA, 1998.

Guyon, I., Matic, N., and Vladimir Vapnik. (1996). Discovering Informative Patterns and Data Cleaning. In Fayyad, U., Piatetsky, G., and Padharic Smyth. Advances in Knowledge discovery and Data Mining. AAAI Press/ The MIT Press, pp.181-203

Han, J., Fu, Y., Wang, W., Krzysztof, K., and Zaiane, O. (1996).DMQL: A data mining query language for relational databases. In Proceedings of SIGMOD Annual Conference, The University of Columbia, USA.

Han, J., Lakshmanan, L., and Raymond T.Ng. (1999). Constraint-based, multidimensional Data mining. IEEE Computer magazine, Aug 1999,pp.46-50.

Imielinski, T. (1996). From file mining to database mining. In Proceedings of SIGMOD Annual Conference, The University of Columbia, USA.

Inmon, W.(1993). Building the Data Warehouse. QED publishing Group.

Inmon, W., and Richard D. Hackathorn. (1994). Using The Data Warehouse, John Wiley & Sons.

Livingston, G., and Bob Rumsby, (1997). Database Design for The Data Warehouses: The Basic Requirements. Planning and Designing The Data Warehouse, Prentice Hall, pp.179-198.

Mattison, R. (1997). Data warehousing and data mining for telecommunications, Artech House.

Milne, R., and Nelson, C. (1995). Knowledge Guided Data Mining. In Colloquium on Knowledge Discovery in Databases, IEE, UK, pp. 6/1-6/3.

Mimno, P. (1997). Data Warehousing Architectures. Planning and Designing The Data Warehouse, Prentice Hall, pp.159-177.

Munton, A., Silvester, J., Stratton, P., and Helga Hanks. (1999). A Practical Approach to Coding Qualitative Data, WILEY.

Paller, A. (1997). A Roadmap To Data Warehousing. Planning and Designing The Data Warehouse, Prentice Hall, pp.17-29.

Pyle, D. (1999). Data preparation for Data Mining, Morgan Kaufmann Publishers.

Quinlan, J. (1986). Induction of Decision Trees. Machine Learning, (1) pp.81-106.

Ramakrishnan, N. and Ananth Grama. (1999). Data mining: From serendipity to science. IEEE Computer magazine, Aug 1999,pp.34-37.

Taha, Y., Helal, A., and K. Ahmed. (1997). Data Warehousing: Usage, Architecture, and Research Issues. ISMM Microcomputer Application Journal,16(2):1-8.

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USING HEURISTIC SELF-STUDY TO RESEARCH INFORMATION SYSTEMS EDUCATION

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ABSTRACT

Using a conversational writing style, I report on a heuristic inquiry research approach used in a five year project investigating technicism and discourse in a University Business Computing teaching reform. Briefly describing the research itself, I concentrate on explaining the nature of heuristic self-study which has both strengths and weaknesses for educational research. To exemplify the heuristic idea of self-dialogue, the paper is in the form of a fictional dialogue.

INTRODUCTION

From 1991 to 1995, I investigated a teaching reform of a University Information Systems Course involving three lecturers, eleven tutors, and hundreds of students. The essence of this reform was to balance a prevailing *technicism* by encouraging *open discourse* through the introduction of teaching and learning strategies such as group work, a dialogical communication process in the tutorials and mass lectures, and requiring students to keep personal learning journals. For example, at the initial computing laboratories, the tutor and students would share their name, computing experience and general educational and work experience. In following laboratories, the tutor would ask students to mention the ways in which they were making progress in learning, and perhaps applying, the information systems concepts and practice in their everyday life. The following quotation from an the Course Unit Outline (Semester One, 1993) describes the format of the learning journal:

The student general learning journals may include some or all of the following headings:

a. A significant personal learning experience a powerful learning highlight (what you learnt, and how you learnt it) that was personally relevant to either your life and/or work. This would not usually be a formal or conceptual insight but rather an existential experience to do with your personal journey of discovery in this area. You should also include insights or experiences made during the week either at work or at home. We would be especially interested in any insight you may have regarding the way in which this unit may be part of your overall intellectual and moral development and also in comments on the affective area (feelings or emotions).

b. Reflective examination of your own performance and contributions in lectures and tutorials, and your participation in the unit. A record of your comments or questions made in lectures or tutorials should be noted as should, perhaps more importantly, any relevant informal discussions or interactions either with the learning group or outside. You could also comment on your perceptions of the personal and communal group dynamics in the tutorials (for example, who is doing what and why; if and how the learning group is helpful to the learning process,

> formal and informal leaders, co-operation, etc.)
>
> c. Every second week you should include newspaper and journal article clippings that have contributed to your learning experience.
>
> In an introduction to the journal you should list your beginning competency level and previous experience (approx. one page) and your expectations for the course (approx. one page). A reflective summary (approx. one page) and an account of your own values and goals with relevance to information technology (approx. one page) should conclude the journal (Information Systems Course Outline, second semester, 1993, p. 4).

As well as discussing points raised in their journals with individual students, I also discussed interesting general points with groups of students. I used interpersonal communication skills such as active and passive listening and 'I' language (Gordon, 1976) to encourage students to ask and answer questions. I forced myself to wait in silence until a reply came from the group and then to wait for several seconds before replying or responding to any student comment.

For two years, I collected qualitative research data concerning the impact of the teaching reform. However, through a component of self-study in the research, I came to understand that I, myself, had succumbed to a form of *inner technicism* in my conduct of the research. I had *imposed* the teaching strategies on the students and tutors, not gaining their *full* permission or imparting *sufficient* understanding of the research, in my drive to gain a research result. I was thus led to conduct an heuristic inquiry with the question "what was the underlying reasons for the ethical shortcomings, and how could I address this problem?".

OPEN DISCOURSE AND TECHNICISM

Open discourse is communication concerning personal and social meaning, purpose, orientation, values, goals, concepts, ideas, feelings and emotions relevant to, but distinct from, the narrow subject matter, technique and administration of University Business Computing education. In a University Business Computing tutorial, for example, open discourse could occur in the initial introductions of the participants or in initial statements of the meaning and purpose of the subject to students' life situations or goals. Any discourse specifically concerned with matters of computing techniques or the terminology of the text would not be open discourse (although open discourse may occur if the discussion broadens to include personal, historical or societal issues relating to the meaning or purpose of the techniques).

Open discourse does not necessarily have to be formal small group or whole group discussion. It may even be a passing comment to an individual student after the end of the computing laboratory, or an informal chat to a group of students in the campus grounds, or even a note on assessing a student's work (written communication can also be discourse). The teacher and students can be autonomous, free, well-rounded human beings able to engage in meaningful and balanced discourse even in spite of a technicist curriculum (Taylor and Campbell Williams, 1993b).

Technicism is an over-emphasis on technical, instrumental or strategic techniques or actions, to the detriment of wider human communication, human values or human purpose (Adorno & Horkheimer, 1990; Dryzek, 1990; Ellul, 1990; Habermas, 1972; Marcuse, 1964, 1969). Persons thinking in technicist ways would tend to define all human problems in terms of rational and technical solutions, thus leading to an undue emphasis on the science, instrumental rationality and technology of the modern age (Bowers, 1988, 1993 a, 1993 b; Ellul, 1964, 1973; Habermas, 1971).

A DIALOGUE

In this paper, written in the form of a dialogical style, I report on the research, emphasising the opportunities and challenges afforded by heuristic research. As part of the *self dialogue* (Moustakas, 1990) component of heuristic research I conducted the following inner dialogue with myself, with a figure I named Auguste Comte acting as a devil's advocate.

Comte: If the 1991 to 1993 qualitative study was flawed, why didn't you just discard it and begin a new investigation?

Mark: Professor C. S. Lewis's (1943) writes:

> A wrong sum can be put right: but only by going back till you find the error and working it afresh from that point, never by simply *going on*. Evil can be undone, but it cannot "develop"

> into good. Time does not heal it. The spell must be un-wound, bit by bit, "with backward mutters of dissevering power" or else not (p. 9).

If I did not unwind the 'spell' that caused me to ruin the first empirical study, could it not return to ruin a second attempt? So, "with backward mutters of dissevering power" (p. 6), I decided to investigate my ethical shortcomings. To explore my hunch that I had succumbed to an inner technicism, I entered a new phase of the research by employing what Moustakas (1990) terms heuristic inquiry to reflect on "what was the reason underlying my ethical shortcomings, and how could I address this."

I thought it legitimate to heuristically analysis some of the research data from my flawed 1991 to 1993 qualitative study. The impressions thus gained about technicism and open discourse in the outer educational context of the computing classes could act as a backdrop for the heuristic self-study of what I term my *self-as-researcher*. The impressions were: (1) that non-interaction in classes was an indication of technicism; (2) that technicism was encouraged by the nature of the tutorial work-book and the way it was used by the tutors; and (3) that I had unethically operated from an inner technicism in unethically imposing the research on the students and other teachers.

I use Lenzo's (1995) term "researcher-as-self" to allude to the way in which "I" was involved in the research. I use the term *true self*, or *Self*, to refer to that fundamental and central inner energy of a person which actualises the wholeness of the psyche and is the culmination of personal development (Jung, 1968, p. 199).

Comte: Let's begin with the study, before you launch into metaphysics. What labels would you use to describe your research?

Mark: The study could be labelled using various categorisations. I conducted an heuristic inquiry re-examining the research material that I had collected in the 1991 to 1993 qualitative study which I discontinued. Building on one of the impressions I gained, I conducted a psychologically-based heuristic reflection from 1993 to 1996. According to Lancy's typology (1993, pp. 7, 11, 15, 183), my study can be said to be an independent, teacher-researcher, personal account. Personal account (Lancy, 1993, p. 7) can be autobiography, biography or oral history employing long-term interview, diary, journal and content analysis with typical foci being the process of becoming a teacher and the relation of teaching to other aspects of the life cycle. As an independent study (Lancy, 1993, p. 11), my study investigates issues that would not be likely to attract the interest and attention of a quantitative researcher. A teacher-researcher (Lancy, 1993, p. 15) research study implies that the role of the investigator is that of teacher and that of researcher.

Lancy (1993) points out that a research written as an autobiography does not need to generate assertions or make judgements on the material. As Lancy comments, I am comfortable with the suggestion that "there is no single interpretation. Each reader must deconstruct . . . the texts for her/himself" (1993, p. 182). In my research, I did interpret research material gleaned from students and research assistants and other lecturers and tutors, but only to elucidate my own autobiography of the study. Nor was it my objective to generate and test assertions such as "using this or that technique can lead to balanced attitudes".

Comte: Was your research a case study? Did it involve ethnography?

Mark: Because I concentrate on giving an autobiography of my own personal history, my study is not an ethnographic study. In other words, the primary purpose is not to give "analytic descriptions or reconstructions of cultural scenes and groups" (Goetze & LeCompte, 1984, p. 2). Indeed, my approach does not fit neatly into Goetze and LeCompte's classifications (1984, Chap. 1). Neither was my research a case study according to Lancy's definition (1993, p. 183).

Comte: Quite unusual. So you did not adhere consistently to your original research hypothesis?

Mark: I took it that in conducting qualitative constructivist research, it was legitimate to allow for the evolution of research interests and foci (Lincoln & Denzin, 1994; Erickson, 1986; Guba & Lincoln, 1989). In my qualitative research from 1991 to 1993, my original intention was to conduct pre-intervention and post-intervention surveys supported with qualitative structured interviews to investigate my early implicit hypothesis that discourse could balance technicism in the teaching-learning process of University Information Systems tutorials. In the early stages, I was particularly interested in "discovering and communicating the meaning-perspective of the people studied" (Erickson, 1986, p. 123). In this I included myself. Overall, my aim was "not proof, in a causal sense, but the demonstration of plausibility" (Erickson, 1986, p. 149). But that first phase of the research was so flawed that I moved on to the second phase of psychologically-oriented heuristic reflection (Moustakas, 1990). I have a hope that I have been part of what Daft and Lewin (1990) comment as: "the significant discoveries, the best science, require us to be more venturesome and heretic in research design, and to explore fundamental questions without knowing the answer in advance" (p. 7).

Comte: Your first phase sounds very much like Thomas Barone (1987a) research which Rist (1987) condemns as "all the negative critiques of qualitative work come home to roost in the article it is impressionistic, lacks any evidence of considering either the reliability or the validity of the data, the methods of analysis appear entirely idiosyncratic to the author, and the research question seemed framed once the study was over" (p. 448).

Mark: Yes, I have sympathy with Rist's (1987) critique of Barone's (1987a) research as being "hit and run" fieldwork (p. 448). (That is not to say that Barone's (1987b) reply to Risk does not answer the charges.) The difference is that my *two years* of the first phase of qualitative research was no "blitzkrieg ethnography". However, it was some of the other concerns raised by Rist that reinforced my decision to abandon the first stage of the qualitative research and conduct the psychologically-oriented heuristic reflection (Moustakas, 1990). This reflection led me to make three major heuristic impressions.

Comte: All very interesting Mark, but how did you justify these impressions. Did you triangulate by using multiple data collection methods and sources and by using multiple methodologies and analytical approaches to ensure that you obtained the truth about what happened in your classes and your teaching and your inner awareness?

Mark: I can see that justification, truth and a fixed point of reference to enable triangulation is important for you, Auguste. I prefer to use Richardson's (1994) concept of crystalization rather than the notion of triangulation. Like a crystal, my research is a postmodernist mixed-genre text which reflects and refracts ever-changing pictures and images of my central themes. I did not rigorously triangulate to prove objective truths about technicism and open discourse. However, as Schaller and Tobin's (in press) recommend, I referred to the "quality criteria for interpretive research", which were gleaned mainly from Guba and Lincoln's (1989) work. "Through careful attention to fairness and the ontological, educative, tactile and catalytic criteria for establishing the goodness and, hence, the authenticity of the interpretive research", I endeavoured to adhere (albeit in an unusual way, and with some failures) to the six procedural steps of prolonged engagement, persistent observation, peer debriefing, negative case analysis, progressive subjectivity, and member checks. I did endeavour to show that my impressions and suggestions were sufficiently viable to be taken seriously, with sufficient and clearly specified warrants. However, I concluded that I could not claim the degree of authenticity or trustworthiness which Schaller and Tobin suggested is necessary for interpretive research.

Comte: Even more interesting Mark. Why then, if you could not claim trustworthiness, did you describe these 'impressions' in your thesis?

Mark: I think that it is a question of the degree of authenticity that some authorities expect to see demonstrated in research. I certainly could not claim the degree of trustworthiness that you seem to expect, Auguste. I did demonstrate some degree of adherence to the ontological, educative, tactile and catalytic criteria that Guba and Lincoln (1989) contend is sufficient for authenticity. However, what I think is more important, is an understanding of the nature of heuristic inquiry and heuristic reflection. Incorporating art, poetry and science (Morse, 1994, p. 225), I focused on gleaning impressions about technicism and discourse. While researching, I found myself resonating with the key phrases that Tesch takes from Moustakas (1981, p. 212) to describe heuristic inquiry "an integrative living form", "being involved, committed, interested, concerned", "intuitive visions, feelings, sensings that [go] beyond anything [one] could record or think about or know in a factual sense"; from Colaizzi (1978, p. 67) "imaginative presence", "wondering about"; and from Douglas and Moustakas (1985) "examining with a sense of wonder". With discovery being the emphasis rather than verification, the essence lies in intuition as inner contemplation "at the confluence point of the social sciences and the humanities" (p. 69). My method of reflection, based around insights from Jungian analytical psychology, is similar to what Colaizzi (1978) terms "phenomenological reflection". As Tesch (1990) describes, in phenomenological reflection:

> The phenomenon rises to clearer awareness by approaching it from different angles, for instance from a metaphorical, or a mythical, or a poetic perspective. Phenomenological reflection is a process of "wondering about" and searching, delving into a phenomenon, awaking to it, and letting oneself be inspired (p. 70).

Reflective phenomenology "aims at a descriptive understanding of psychological phenomena by reflectively disclosing their meaning" (Colaizzi, 1978, p. 68). I do not concentrate on a descriptive understanding of the *experience* of inner technicism. I concentrate on giving *descriptive impressions* about technicism and open discourse, based on my heuristic inquiry and psychological self-study which included inner discourse. I do not concentrate on giving impressions about *my experience* of technicism or open discourse or inner discourse. I understand this as the major difference between my heuristic inquiry (Moustakas, 1990) as distinct from reflective phenomenology (Colaizzi, 1978; Moustakas, 1994). Moustakas (1956, 1959, 1966, 1969 a & b, 1981 a & b, 1990, 1994) has been a pioneer in developing and applying both heuristic inquiry and reflective phenomenology.

Tesch (1990, p. 171) commented that researchers conducting reflective phenomenology do not necessarily adhere to some of the canons of trustworthiness that have been established for qualitative research. She adds that, when considering the results of the research, it is up to the reader: "to decide for yourself whether you want to consider them to be 'legitimate'" (p. 171). Her comment holds true for my heuristically gained impressions, and that is partially why I was bold enough to describe them.

Comte: So you are saying that your appropriation of some kind of mix of heuristic inquiry, and psychological reflection, enabled you to find justification for describing your impressions. I hope that there is more reason than this.

Mark: Yes Auguste, there is something more. The substantive issue, at the heart of my research, evolved to be an investigation of technicism and open discourse from both an inner, psychological perspective and an outer, educational perspective. The inner strategic rationality and reflective inner discourse related to the outer technicism and open discourse in the University Information Systems education. I dialogically move between describing impressions of technicism and open discourse in the computing classes and the inner technicism and inner discourse of my pedagogical self. As we all do, to a greater or lesser degree of consciousness, I carried out a dialogue between that part of me experiencing the outer world and my inner world. The difference was that I consciously used this dialogue to gain descriptive impressions about the nature of technicism and open discourse.

Comte: How exactly does one gain an heuristic impression?

Mark: Moustakas (1990) states that there are usually four phases to an heuristic inquiry: (1) framing the questions; (2) carrying the questions within; (3) listening to other voices; (4) tying it all together. The framing of my questions took place in late 1993 to 1994 as I reflected on ethical flaws in my 1991 to 1993 qualitative study. By carrying the question within, I experienced all the aspects of this phase as described by Moustakas (1990, pp. 28-31) as immersion, incubation, illumination, insights, and explication. In the insights process, I dialogically gained insights into both the inner and outer nature of technicism and discourse. As part of the explication process, and the 'tying it all together' phase, I identified and then explained the insights that seemed to me to be most relevant to responding to the research questions. Moustakas explains that the tone of the heuristic research tradition is to offer responses, insights or conclusions to the research questions. The phrase "impressions about technicism and open discourse" seemed to me to be more elegant than "insights into the nature of technicism and open discourse". After some thought, I came to the conclusion that the word *impression* was a justifiable synonym for the words Moustakas uses.

Comte: But did the research make any difference to yourself, or to anybody, with respect to information systems?

Mark: For myself, I found the main change to my information systems teaching came from being inspired to become what Schon (1983) terms a *reflective practitioner.* I was also inspired by Mark von Wodke's (1993) book, *Mind over Media: Creative Thinking Skills for Electronic Media.* I introduced the physical stretching and mental relaxation exercises suggested by von Wodke (1993) into the computer laboratories. Von Wodke asserts that ergonomic, relaxation and imagination activities, even to the point of including Jungian dream interpretation and journal writing, encourage creativity and mental and physical health whilst using computers. For example, as the computers were turning on, I encouraged the students to sit straight, close their eyes and breath slowly and deeply while silently repeating "calm body, alert mind" while breathing in and letting go of tension while breathing out. As the application was loading up from the menu I asked them to join with me in stretching across to the left and then to the right. I stressed the value of ergonomic approaches and the resting of eyes and body. In my postgraduate seminars, and even at times in the undergraduate mass lectures, I guided the students in brief mental relaxations. At times I included visualisations such as imagining a splendid flower blossoming on the computer screen or imagining a rural walk with sun and grass and flowers and breeze. Professor Robert Flood (verbal answer to a question at the keynote address of the Australian Systems Conference, 26 September, 1995) refers to these sorts of practices as physical and mental ergonomics. I encouraged the students to read von Wodke's (1993) book, and even suggested they try out his ideas on reflective journals and dream journals.

Comte: Well, I guess it takes all types to make up the world. But do you have any conclusion from your study?

Mark: I have already stated my three impressions. My third impression, about my innertechnicism, is about the psychology of doing research. My tentative conclusion is that the deeper levels of the human psyche, if not recognised and honoured in self-reflective practice (Schon, 1983), will (paraphrasing Norris, 1992, p.180) disrupt even (especially?) our most noble and well-framed attempts at educational reform. As a further research interest, I am exploring the idea that unconscious agendas play a role in the success or failure of information systems projects (Campbell Williams, in press b).

SUMMARY

In this paper, I mention some aspects of the heuristic inquiry which I undertook as a consequence of my heuristic analysis of my flawed qualitative project of 1991 to 1993. I was led to dialogically explore understandings and experiences of technicism and open discourse in the outer world of the University Information Systems teaching reform, and in the inner world of my own pedagogical self. This is a complex notion. Jung (1968) contends that the dialogue between the outer and inner worlds, the conscious and the unconscious, although of vital importance in almost every area of human pursuit, is often neglected, usually at a cost. I explored this dialogue in the context of reflecting heuristically on a teaching reform in a University Information Systems course. I think that the conscious-unconscious dialogue is present in any research, and is pervasive in academia, but largely ignored, usually at a cost (Campbell Williams, in press a). For some researchers the cost may be high. What price is the self? or the soul (Campbell Williams, in press b)? For science in general, some would contend that lack of reflectivity, including lack of awareness of the unconscious, lies near the heart of some failures, perhaps *the* failure, of the scientific project of modernity (Adorno & Horkheimer, 1992; Bowers, 1992; Habermas, 1972; Marcuse, 1964, 1969).

Heuristic research, even in management information systems research, is not:

> "Madness, you mean?" said the Professor quite cooly. "Oh, you can make your minds easy about that. One only has to look at her and talk to her to see that she is not mad."
>
> "But then," said Susan, and stopped. She had never dreamed that a grown-up would talk like the Professor and didn't know what to think.
>
> "Logic!" said the Professor half to himself. "Why don't they teach logic at these schools?..."
>
> "But do you really mean, sir, " said Peter, "that there could be other worlds all over the place, just around the corner like that?"
>
> "Nothing is more probable," said the Professor, taking off his spectacles and beginning to polish them, while he muttered to himself, "I wonder what they *do* teach them at these schools" (Lewis, 1950, p. 49).

In this paper, I have endeavoured to demonstrate that, indeed, there are other worlds of research "all over the place, just around the corner" (Lewis, 1950). The research world of heuristic inquiry probably seems strange to some, as, I guess, does my research writing style. But there remains a serious question: "Can heuristic research and unusual research writing lead us to new truths? Or, perhaps, to revisit old truths, in new ways?"

REFERENCES

Adorno, T, & Horkheimer, M. (1992). *The Dialectic of Enlightenment*. London: Verso.

Barone, T. E. (1987 a). "On Equality, Visibility, and the Fine Arts Program in a Black Elementary School: An Example of Educational Criticism. *Curriculum Inquiry, 17* (4), 425-446.

Barone, T. E. (1987 b). "Researching out of the Shadows: A Reply to Rist. *Curriculum Inquiry, 17* (4), 453-463.

Bowers, C. (1992). "Ideology, Educational Computing, and the Moral Poverty of the Information Age. *Australian Educational Computing, 7* (1), 14-21.

Bruner, J. (1990). *Acts of Meaning*. Cambridge, Mass.: Harvard University.

Campbell Williams, M. (in press). "Dreaming of the Flowering of University Information Systems Education. In P. Taylor, K. Tobin & P. Gilmer (Eds.), *Sunflowers: The Blooming of College and University Education*. Hillsdale, NJ: Lawrence Erlbaum.

Campbell Williams, M. (in press b). "Critical Theory, Carl Jung, Symbo-construction in Soft Systems Rich Pictures, and the Reflective Practitioner. In F. Stowell (Ed.), *Proceedings of the 1997 United Kingdom Systems Society Conference*. Milton Keynes, U.K.: Open University.

Colaizzi, Paul F. (1978). "Psychological Research as the Phenomenologist View It. In Valle, Ronald S. & King, Mark (Eds.) *Existential-phenomenologist Alternatives for Psychology* (pp. 112-137). New York: Oxford University.

Derrida, Jacques. (1976). *Of Grammatology*. (Gayatri Chakravorty Spivak, Trans.). Baltimore: John Hopkins University Press.

Derrida, Jacques. (1978). *Writing and Difference*. (Alan Bass, Trans.). Chicago: University of Chicago Press.

Derrida, Jacques. (1987). *The Post Card: From Socrates to Freud and Beyond*. (Alan Bass, Trans.). Chicago: University of Chicago Press.

Douglas, B. & Moustakas, C. (1985). "Heuristic Inquiry: the Internal Search to Know. *Journal of Humanistic Psychology 25* (3), 33-55.

Erickson, F. (1986). "Qualitative Methods in Research on Teaching. In M. C. Wittrock (Ed.), *Handbook of Research on Teaching (3rd ed.)*, (pp. 119-161). New York: MacMillan.

Felperin, H. (1985). *Beyond Deconstruction: The Uses and Abuses of Literary Theory*. Oxford: Clarendon.

Gordon, T. (1976). *P.E.T. in Action*. New York: Perigee.

Guba, E. G. & Lincoln, Y. S. (1989). *Fourth Generation Evaluation*. Beverley Hills, USA: Sage.

Habermas, J. (1972). *Knowledge and Human Interests* (Jeremy J. Shapiro, Trans.). London: Heinemann.

Jung, C. (1968). "Approaching the Unconscious. In C. J. Jung (Ed.), *Man and His Symbols* (pp. 1-95). London: Aldus Books.

Lancy, D. F. (1993). *Qualitative Research in Education: an Introduction to the Major Traditions*. New York: Longman.

Lenzo, K. (1995). "Validity and Self-reflexivity Meet Poststructuralism: Scientific Ethos and the Transgressive Self. *Educational Researcher, 24* (4), 17-23.

Lewis, C.S. (1943). *The Abolition of Man*. London: Fount.

Lewis, C. S. (1950). *The Lion, the Witch, and the Wardrobe*. London: William Collins.

Lincoln, Y. S. & Denzin, N. K. (1994). "The Fifth Moment. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 575-586). California: Sage.

Lomax, P. & Parker, Z. (1995). "Accounting for Ourselves: The Problematic of Representing Action Research, *Cambridge Journal of Education 25* (3), 301-314.

Mahoney, J. (1977). "Strategic Management and Determinism: Sustaining the Conversation. *Journal of Management Studies, 30* (1), 174-191.

Marcuse, H. (1964) *One Dimensional Man.* London: Routledge and Kegan Paul.

Marcuse, H. (1969) *Eros and Civilisation.* London: Allen Lane & Penguin.

Morse, J. (1994). "Designing Funded Qualitative Research. In S. Guba & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 220-235). Thousand Oaks, CA.: Sage.

Moustakas, C. (1956). *The Self: Explorations in Personal Growth.* New York: Harper.

Moustakas, C. (1959). *Psychotherapy with Children: The Living Relationship.* New York: Harper.

Moustakas, C. (1966). *The Authentic Teacher: Sensitivity and Awareness in the Classroom.* Cambridge, Mass: H. A. Doyle.

Moustakas, C. (1969a). *Individuality and Encounter: a Brief Journey into Loneliness and Sensitivity Groups.* Cambridge, Mass: H. A. Doyle.

Moustakas, C. (1969b). *Personal Growth : the Struggle for Identity and Human Values.* Cambridge, Mass: H. A. Doyle.

Moustakas, C. (1981a). "Heuristic Research. In Peter Reason & John Rowan (Eds.) *Human Inquiry: A Sourcebook of New Paradigm Research* (pp. 207-17). Newbury Park: Sage.

Moustakas, C. (1981b). *The Authentic Teacher: Sensitivity and Awareness in the Classroom.* Cambridge, Mass: Howard A. Doyle.

Moustakas, C. (1990). *Heuristic Research: Design, Methodology and Applications.* Newbury Park: Sage.

Moustakas, C. (1994). *Phenomenological Research Methods.* Thousand Oaks, CA: Sage.

Norris, C. (1992). "Deconstruction, Postmodernism and Philosophy: Habermas on Derrida. In David Wood (Ed.), *Derrida: A critical reader* (pp. 167-192). Oxford: Blackwell.

O'Connor, P. (1981). *Understanding the Mid Life Crisis.* Melbourne: Sun Books.

Richardson, Laurel (1994). Writing: A Method of Inquiry. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 516-522). California: Sage.

Rist, R. (1987). "Research in the Shadows: A Critique of 'On Equality, Visibility, and the Fine Arts Program in a Black Elementary School: An Example of Educational Criticism.' *Curriculum Inquiry, 17* (4), 447-451.

Sanford, J. A. (1989). *Dreams: God's Forgotten Language.* New York: Harper and Row.

Schaller, P. & Tobin, K. (in press). "Quality Control and the Genres of Qualitative Research. In P. C. Taylor, K. Tobin & P. Gilmer (Eds.), *Sunflowers: The Blooming of College and University Ed.* Hillsdale, NJ: Lawrence Erlbaum.

Schon, D. (1983). *The Reflective Practitioner.* U.S.A.: Basic Books

Tesch, Renata. (1990). *Qualitative Research: Analysis Types & Software Tools.* Hampshire,

von Wodke, M. (1993). *Mind over Media: Creative Thinking Skills for Electronic Media.* New York: McGraw-Hill.

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PROBLEM-BASED LEARNING ASSESSMENT FOR INFORMATION SYSTEMS COURSES

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ABSTRACT

A promising recent development in tertiary education involves the application of problem-based learning as a curricular vehicle to develop student talent. Problem-based learning (PBL) is common in professional education, such as in medical, law, and business schools, and is becoming increasingly common in pre-college education. However, it is less common in information systems education. We have successfully applied PBL to information systems courses, and are reporting our results in this paper. Moreover, there is a major difficulty in applying PBL as there is no formal methodology of assessing students' work. This paper explores this issue by creating an instrument for assessment in a PBL setting. The instrument has been specifically designed to evaluate the generic abilities and skills of information systems graduates. We also recommend that the instrument or a modified version of the instrument be used for assessing other subject areas when the PBL is applied. The instrument has been proved to be a successful tool for assessment of the PBL. The result of applying this assessment instrument to our information systems courses will also be presented.

INTRODUCTION

Problem-based learning (PBL) is an educational strategy that uses problems as the starting point for student learning (Bligh, 1995). It is a curriculum design and teaching/learning strategy, which recognizes the need to develop problem-solving skills as well as the necessity of helping students to acquire the necessary knowledge and skills (Boud & Feletti, 1997; Biggs 1999). The main issue is to reduce direct instruction as students assume greater responsibility for their own learning. Students are given ill-structured problems through which they develop high-order thinking and problem-solving skills. The shift in the teaching and learning process is more student-centered than teacher-centered. The role of the teacher is to encourage student participation, provide guidance to students, offer timely feedback, and assume the role of learner as well (Aspy et al., 1993). Evidence of the success of problem-based learning as an instructional strategy is strongly positive, particularly in fostering increased knowledge retention (Norman & Schmidt, 1992), encouraging general problem-solving skills, for deep-biased students (Norman & Schmidt, 1992; Lai, Tiwari & Tse, 1997), promoting self-directed learning skills, and increasing intrinsic interest in the subject matter. Since its introduction as an instructional method used in the medical school at McMaster University in Ontario in the 1960s, PBL has spread to numerous educational institutions around the world. To the best of our knowledge, the PBL strategy has not become so popular in the field of computer science and information systems. We have applied the methodology for the first time in our respective institutions quite successfully. The course that we applied it in our discipline was Systems Analysis. Students had to take greater responsibility for coming up with a solution for a given problem case. The details of this application follow this section.

Aligning PBL activities and subsequent student assessment often proves to be difficult for teachers, with many PBL activities followed by traditional assessment confusing students by disrupting their understanding of teacher expectations. Traditional assessment generally requires that students memorize the content of teaching materials without understanding. Once the examination is over, everything has been forgotten. Students learn to pass examinations without understanding what they should have learnt. On the other hand, if assessment requires students to solve problems, then they collect as many sample solutions of problems as they can. The key issue is to assess students so that they learn what we want them to learn. Quite a few PBL assessment models have been adopted, but they may not be appropriate to assess the generic quality of IS graduates. In the remainder of this paper, we describe some of the most recent PBL assessment strategies that have been adopted by different scholars, present an instrument which is particularly designed for the assessment of IS subjects when the PBL approach to teaching is applied, and finally our experience of applying this assessment instrument to IS courses in the fall of 1999. The main focus of this paper was the development and implementation of an assessment instrument when the PBL strategy is applied.

PBL ASSESSMENT MODELS

The study of problem-based learning assessment has been taken in two different directions by researchers; namely assessing the value of a problem-based learning curriculum, and student assessment in a problem-based learning approach. In this work we are concerned with the latter issue that is how to assess students' work. When we first applied PBL to our information systems courses, the first problem that we encountered was how to assess students' work in a PBL setting. Many instructors and researchers who apply or study the assessment of PBL have concerns about these issues. For example, Woods (1996) asks, "how do we handle tests in the context of small group, self-directed, self-assessment PBL?" There is, however, no general and systematic answer to this question, because students may be working alone, or in teams, and doing work that doesn't fit into readily assessable products. Researchers have been working on PBL assessment for many years and have taken different approaches. These diverse approaches in PBL assessment as pointed out by Sundberg (1999) are due to different factors that will impact on the success of student-active innovation. These include the culture of the institution, the department, or even a particular subject. Reis and Renzilli (1991) claim that the major weakness of historical and contemporary PBL efforts is the lack of formal student evaluation. In the literature, there are many studies of PBL assessment in different subject areas. Generally speaking, they all share the same concern. However, the approaches responding to these concerns differ from subject to subject and from institution to institution. In the following we present some of the most recent research results.

Nowak and Plucker (1999) provide suggestions for aligning instructional activities and assessment in the PBL process. This suggestion assumes three categories of students. In the first option, the assumption is that students are professional in the subject area of the instruction, and the instructor is their supervisor. The second suggestion is that the PBL assessment should be structured in the area of the student outcome. They provide reasonable guidelines regarding the instructor's expectation from the students. Finally, the third suggestion states that instructors should hold off an assessment until the end of the activity or until the unit of work is complete.

In the mental measurements yearbook, Buros (1999) has compiled several instruments that can be used for PBL assessment. Many faculty of McMaster University have adopted a modified version of these instruments. Some of these instruments include testing of subject knowledge, problem-solving skills, metacognitive skills, lifetime learning skills, and critical thinking skills.

Hicks (1998) classifies assessment of a PBL subject into four categories, namely teacher observation, student-produced written material and products, peer and self-evaluation, and feedback from the outside community. All of these four different classifications have the same outcome objectives, such as basic skills, and critical thinking skills. Hicks points out that the hardest to assess are the attributes and disposition of students, such as empowerment, diligence, empathy and pride.

Woods (1998) has proposed several units of skills for assessment of chemical engineering courses at McMaster University. These units focus on individuals solving relatively well-defined problems, interpersonal skills and group problem-solving, and messy problem-solving skills. Woods (1996) has also provided a general guideline for PBL assessment directed mostly towards chemical engineering courses.

The SOLO taxonomy (Boulton-Lewis, 1998) is based on the study of outcomes in a variety of academic content areas. It stands for Structure of the Observed Learning Outcome. It has five levels of taxonomy: prestructural, unistructural, multistructual, relational and extended abstract. It is intended to measure the students' quantitative and qualitative increase in understanding of the subject. In quantitative terms, it measures how much students can memorize and recognize terminology and a disorganized set of items. It also measures the students' performance in qualitative terms. That is how students relate, apply, generate, reflectand theorize of the subject taught. At this level, students are able to apply theory to practice for problem-solving.

Assessment by portfolio (Gibbs, 1998) requires the student to be acquainted with the course objectives and is asked to provide evidence that learning relevant to those objectives has been achieved. This requires the learner to recognize the nature and quality of his or her own learning. The student presents his or her best 'learning' against the objectives. Students have to use their judgments in assessing their own work. There are two drawbacks. First, the students may claim something, which he or she did not do. Second, the portfolio may require that students work excessively and create work both for themselves and for the teachers.

Triple jump (Feletti, 1997) uses a three-step exercise, with the student evaluated at each step: step one deals with the problem case; diagnosing, hypothesizing, checking with the database, use of information, reformulating. Step two tests them on independent study: knowledge gained, level of understanding, evaluation of information gained. Step three is concerned with final problem formulation: synthesis of key concepts, application to problem, self-monitoring, response to feedback.

Researchers at the University of Wisconsin (Stone, 1996) have adopted a new PBL assessment that they call ability-based assessment, in which they have identified nine generic abilities that a medical graduate should pass to be admitted into residency training. These abilities include appraisal, analysis, assessing own and peer performance, self-directed learning, handling stress, completing tasks, communications, consideration of professional ethics in decision-making, and interpersonal skills. Multiple-choice testing has been replaced by this activity-based assessment.

(Trevitt C. and Pettigrove M., 1995) have been using a combination of assessment and self-assessment to a fire science and management course using five criteria, namely class tests, oral debrief exercises, district committee fire management plan proposal, take home assignments and presentation. The main goal of their work is to increase the emphasis on inducing students into the process of self-evaluation according to specified criteria.

The above PBL assessment strategies have been designed for specific objectives and for specific disciplines. To the best of the authors' knowledge, no PBL assessment tool has been developed for information systems courses. When we first applied PBL teaching strategy to our courses the assessment of students' work was a major concern for both students and instructors. Students were concerned how their work would be graded and instructors were also concerned because there were no formal test or quizzes. To make the application of PBL strategy to our courses more practical and successful we have developed an assessment instrument for information systems courses that we have applied to our courses. The details of how the instrument was developed and subsequently applied are given below.

PBL ASSESSMENT INSTRUMENT

Information systems graduates (specially systems analysts) must have certain skills and ability and be prepared for industry. There is little doubt that information systems graduates should be able to

- work independently and in a group environment,
- solve a problem logically and systematically, with little or no supervision,
- understand how to acquire knowledge for problem-solving,
- have critical thinking and problem-solving ability, and
- communicates effectively (both orally and in writing)

Students must be equipped with the academic knowledge and the practical skills for problem-solving. They must understand how the theory is applied to practice, and know the circumstances necessary for achieving the cost-effective solution. There are several issues that concern a teacher: first, what the students need to know academically; second, the skills they need to have; third, how they apply their skills and academic knowledge to know effectively when and why it is appropriate to do these things? The third should be an alignment between the curriculum objectives and assessment. That is to say, how well students know the subject, how well they have learnt, and at what level.

PBL activities support the development of 'preferred IS graduates', which also leads to long-life learners. When the PBL approach is adopted, there is some concern about how students are to be assessed with a practical and manageable assessment mechanism. The assessment of students should be aligned with their generic abilities. The assessment techniques mentioned above have targeted specific subject areas that are not necessarily suitable for IS courses. Thus, based on the previous work done by other researchers, we have created an assessment instrument specifically for IS courses. The instrument consists of a list of nine criterion skills, listed in Table 1. For each criterion skill, we have proposed a set of tasks that must be fulfilled to develop the given criterion skill. These tasks are listed immediately following Table 1. An instructor can use some or all of these tasks to assess students' work for that skill. The authors used this instrument in their information systems courses in the fall of 1999. The outcome of this experiment follows the list of criterion skills. Although the focus was on IS courses, most of these criteria can be used for other subject areas as well.

Table 1 shows the criteria that have been developed and used by the authors to assess students' work in information systems courses. For each criterion skill, we have developed a set of tasks that can be used for assessment. The details of these tasks are listed in Appendix A.

APPLICATION OF PBL AND ASSESSMENT INSTRUMENT

The authors have taught systems analysis and design for a number of years using the traditional approach. This subject is taught at the upper level of a computer science (CS) and IS program. In an effort to develop students' talents and enhance their learning, the authors decided to apply the PBL strategy to the teaching of this course in their respective institutions for the first time in the fall of 1999. The application of PBL was done with close coordination and communication between the authors.

The systems analysis course in which we chose to apply PBL is offered once a year. The course meets three times a week, two of which are lectures and the third meeting is lab/tutorial. The course was designed to be project-oriented, that is there was no formal test or quizzes, but all course requirements were fulfilled through projects. Every week there were two hours of lecture and one hour of lab/tutorial. Students worked in groups of up to six. They were assigned several ill-structured problem cases during the semester. For each problem case, students worked together to come up with a solution. During the lab/tutorial hour, the students worked on a certain aspect of their project that required group meeting, such as dividing the work among themselves, and setting future meeting dates. The instructor took the role of a coach monitoring their work.

Students were assigned several ill-structured problem cases. For each problem case, they were required to submit both individual and group work in the form of

TABLE 1
LIST OF CRITERION SKILLS FOR PBL ASSESSMENT

No	Criterion Skills	Description
1	Problem understanding	Evidence of problem understanding and independent study
2	Use of resources	Evidence of determination & utilization of information resources
3	Teamwork	Evaluation of student's teamwork success
4	Critical thinking	Evidence of practical and optimal solution
5	Management skills	Setting deadlines; finishing on time
6	Writing skills	How well and professionally the work is written
7	Oral presentation	How presentation is done
8	Team communication	How well the student communicates with team members
9	Self-assessment	Seriousness and accuracy of self-assessment

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log their projects solutions as well as their projects. The assessment instrument have been used to grade students' work. Each question in our assessment instrument were given a weight from 5 to 1 with 5 being the highest score and 1 being the lowest. This grading scale was used to grade their project work.

In the early stage of the PBL approach introduction, the change of students' attitude towards the subject and especially towards the learning process became obvious. Students found the learning activities, such as teamwork, critical thinking, and problem-solving more meaningful than the traditional approach of lecturing and taking multiple choice or short answer tests. Nevertheless, the students' main concern was assessment. Questions like, "How will you grade our work?" were raised frequently. Application of assessment instrument reduced student's anxiety significantly. This task could only be taken care of so quickly through the coordination and communication of the authors. After their first project, they developed more faith in our assessment methodology and were convinced that the assessment was relatively fair and accurate. For their subsequent projects, they showed less anxiety about their grade and focused on their learning activities. Students spent more time studying and preparing their projects in the PBL approach than in the traditional approach. The major focus of this course was the development and application of assessment instruments in PBL. The learning outcome has been very positive, and the informal feedback of students was favorable. Here are some quotes from students in our courses " I learned systems analysis topics without much memorizing", " I enjoyed working in a team", "PBL requires hard work and is a new learning experience", and "The course was challenging and fun". It is planned to have a formal survey on the students' perception of our adopted assessment instruction, the result of which will be presented in another paper.

CONCLUSION

We have successfully applied the PBL strategy to IS courses and it was an exciting experience for both students and instructors. It proved to be superior to the traditional approach to teaching in many ways. First, students' learning activities, including reading, searching, and writing, were much higher than when traditional teaching was applied to the same course. Second, the level of interaction among students was much higher. Third, the students had to keep a portfolio of their learning activities, which assisted them to be in control of the topics to be learnt. The major concern among educators who apply the PBL strategy is assessment of students' work. Evaluation of student achievement is an important aspect of education, and the skills required for solving real-world problems must be included in that assessment. In addition, alignment of instruction and assessment is essential when the PBL approach is to be used. In response to this important concern, we have developed and applied an assessment instrument that is targeted towards the generic skills of IS graduates. The assessment instrument has created a unified framework for the instructors to evaluate students' work; otherwise the assessment would have been very difficult. It has proved to be successful in many ways. It has significantly reduced students' anxiety with regard to the accuracy and methodology of assessment as they realize the need to work towards the generic abilities of IS professionals. The instructors had a better ground for evaluation with a checklist that is easy to use for those who wish to apply the PBL strategy in their courses. Although IS graduate skills are the target of our instruments, it can also be fully or partially used for assessment of other subject areas. We have provided a useful tool for instructors who plan to apply PBL in their courses

REFERENCES

Biggs, J. (1999). *Teaching for Quality Learning at University*, Open University Press.

Bligh, J. (1995). *Problem-Based, small group learning.* Student BMJ, 3, 308-309

Boud, D. & Feletti, G.I. (1997). *The challenge of problem-based learning*, London: Kogan Page.

Boulton-Lewis, G.M. (1998). *Applying the SOLO taxonomy to learning in higher education*, Teaching and Learning in Higher Education, Camberwell, Australian Council for Educational Research.

Buros, O.K. (1999). *The Mental Measurement Yearbook*, Gryphon Press, Highland Park, NJ.

Feletti, G. (1997). *The triple jump exercise: a case study in assessing problem solving*, in G. Ryan (ed.) Learner Assessment and Program Evaluation in Problem Base Learning, Newcastle: Australian Problem Based Learning Network.

Gibbs, G. (1998). *Using assessment strategically to change the ways students learn*, Assessing matters in Higher Education: choosing and using Diverse Approaches, Buckingham: Society for Research into Higher Education/ Open University Press.

Hicks, R. (1998). *PBL Workbook (How do I grade?)* Autodesk.com.

Lai, P , A. Tiwari & P. Tse (1997), *Problem-based learning (PBL): Boosting the problem-solving performance of all or some?* Research and development in problem based learning, Vol 4, Newcastle: Australian Problem Based Learning Network, 295-304.

McNeal, A. and D'Avenzo, C. (1999), *Student Active Science*, Harcourt College Pub. Co.

Norman G.R. and Schmidt H.G. (1992). *The psychological basis of problem-based learning: A review of the evidence.* In: Academic Medicine, 557-565.

Nowak, J. and Plucker, J. (1999). *Students Assessment in Problem-Based Learning*, Indiana University. URL: http://www.indiana.edu/~legobots/q515/pbl.html.

Reis, S.M. and Renzulli, J.S. (1991). *The Assessment of Creative Products in Programs for the gifted and talented students.* Gifted Child Quarterly, 35, 128-134

Stone, H. (1996). *An Ability-Based Learning Program at the Medical School of the University of Wisconsin at Madison*, FIPSE Project II.

Sundberg, M.D. (1999). *Assessing the Effectiveness of an Investigative Laboratory to Confront Common Misconceptions in Life Sciences*, Harcourt College Publishers.

Trevitt, C. and Pettigrove, M. (1995). *Towards Autonomous Criterion-Referenced Assessment and Self-Assessment: A Case Study*, School of Resources and Environmental Management and Center for Educational Development and Academic Methods, Australian National University. URL: http://online.anu.edu.au/Forestry/fire/ACFT/assess-TP95.html.

Woods, D. (1996). *Instructor's Guide for "Problem-Based Learning: How to gain the most from PBL"*, 3rd edition, ISBN 0-9698725-0-X. URL: http://chemeng.mcmaster.ca/pbl/chp5-2.htm

Woods, D. (1998). *The MPS Program: The McMaster Problem Solving Program*, Chemical Engineering Department, McMaster University, Hamilton, Ontario, Canada.

APPENDIX A

1. **Problem Understanding Objective**:

Students should be able to:
- Describe all the aspects of the problem
- Have a good idea of what needs to be done to solve the problem
- Have created strategies to solve the problem
- Have demonstrated the ability to work with limited supervision

2. **Use of Resources Objective**:

Students should be able to:
- Prepare a printed copy of the needed material for his/her reading
- Demonstrate his/her attempt to create other resources
- Provide an accurate summary of the search work
- Demonstrate evidence of electronic search
- Relate the prepared information to the given problem
- Evaluate the accuracy and credibility of the searched information
- Create a relation between the prepared information and the real world problem

3. **Teamwork Objective**:

Students should be able to:
- Demonstrate effective communication
- Contribute at least his/her share of the work
- Cope with conflicts
- Evaluate team members' work fairly and honestly
- Share information with team members
- Demonstrate leadership ability
- Initiate discussion
- Help other team members when they are in difficulty

4. **Critical Thinking Objective**:

Students should be able to:
- Propose solutions to the given problem
- Test their proposed solution
- Propose alternate solutions
- Provide reasons or justify the solutions
- Present some background that support the solution
- Evaluate and commend his/her solutions and the work of others
- Present ideas/comments that are useful and constructive

5. **Project Management Objectives**:

Students should:
- Have a good plan, schedule, and means of controlling the project
- Be able to arrange tasks logically and systematically
- Estimate resources reasonably
- Submit their work on time
- Provide a log of all meetings and communications with other team members

- Provide documented evidence of good communication with team members and outside organizations
- Present a record of their submitted work

6. **Writing Objective**:

Students should:
- Produce a professional report
- Provide a good introduction and summary to their report
- Perform a good problem analysis
- Produce a report with good content
- Provide alternative solutions with justification
- Draw a reasonable conclusion
- Provide references in their report
- Demonstrate the ability to convert information into a meaningful report
- Demonstrate any potential prospect for being successful systems analysts

7. **Oral Presentation Objective**:

Students must:
- Explain their work clearly
- Present the essential points of their work clearly
- Use effective visual aids to support the presentation
- Be able to answer questions during presentation
- Be able to behave professionally during presentation
- Be able to paraphrase their understanding of the topic during presentation
- Be able to transfer their knowledge to the students in an appropriate way

8. **Team Communication Objective**:

Students must:
- Have a good understanding of other team members' suggestions and points
- Demonstrate evidence of useful and constructive discussion
- Make suggestions that provide guidelines to the team
- Support their points through discussion
- Provide evidence of making constructive suggestions
- Provide concise and short messages and yet be able to resolve problems

9. **Self-Assessment Objective**:

Students should provide:
- A list of what he/she contributed
- A list of important topics learnt
- A list of accurate assessment of other team members
- A list of what he/she did not learn
- A list of the meetings he/she did not take part in
- A list of items that other students have done on his/her behalf

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THE ROLE OF PERSONAL EXPERIENCE AND SOCIAL INTERACTION IN KNOWLEDGE CREATION AND UTILISATION

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This paper reports the results of an empirical examination of the effects of personal experience and social interaction on individual knowledge and performance in a specific decision making task context. The study revealed a differential effect of increased experience on the quality of participants' decisions. In particular, increased experience did not result in significant decision improvement in the non-interactive social environment, but did so in the interactive social environment. The study also revealed that social interaction was beneficial irrespective of personal experience, and led to better performance at both low and high experience levels. The results suggest that individuals may benefit from, in combination, opportunities for personal experimentation and social interaction with others. These results may be useful to all those responsible for planning knowledge management strategies aimed at enhancing knowledge creation and utilisation.

INTRODUCTION

Information and knowledge management literature repeatedly report that despite large investments and proliferation of programs to improve individual and organisational performance, failed programs far outnumber successes and improvement rates remain low (Garvin 1998; Sauer, 1993; Swanson, 1988). It has been claimed that it is because these companies failed to grasp the basic truth, that before people or organisations can improve they first must learn. The literature suggests that to remain competitive, or even to survive, in today's uncertain economy with shifting markets, proliferating technology, multiple competitors and shortening product life, companies will have to convert themselves into "learning organisations (Garvin, 1998), "knowledge-creating organisations (Nonaka, 1998), and "organisations of knowledgeable specialists (Drucker, 1998).

While there seems to exist a growing recognition of the importance of learning and knowledge for competitive advantage or survival (Devenport & Prusak, 1998; Davenport et al., 1998; Drucker, 1993; Grayson & Dell, 1998; Stewart, 1997), the complexities of learning and the large number of interacting factors which affect individual and organisational learning present many challenges. Scholars define learning organisation as skilled at creating, acquiring and transferring knowledge and modifying its behaviour accordingly (Garvin, 1998); as a place where people continually expand their capacity to create desired results, new thinking patterns are nurtured, collective aspirations are set free and people learn how to learn together (Senge, 1990); and a place where inventing new knowledge is a way of behaving or being, and in which everyone is a knowledge worker (Nonaka, 1998). Some authors suggest that the typical organisation of tomorrow will resemble a symphony orchestra or the university in which professional specialists will direct and discipline their own performance (Drucker, 1998).

It is argued that any company that wants to compete on knowledge must learn techniques of knowledge creation. Some clues as to what knowledge-based organisations will require may come from other knowledge-based entities (e.g. university or symphony orchestra). Western theorists have been recently criticised for having too narrow view of organisation and knowledge (Nonaka, 1998). They tend to consider organisation as an information-processing machine and focus mostly on hard information stored in organisational codified repositories as a main source of "explicit objective and systematic knowledge. Japanese theorists, on the other hand, recognise the importance of "tacit knowledge that people gain through experience and sharing (Nonaka & Takeuchi, 1995). Considering that between 40% (AAOTE, 1998) and 90% (Hewson, 1999) of the needed knowledge in organisations is tacit, it is not surprising that there is a growing interest among the practitioners and academics alike to better understand how to tap into the wealth of knowledge in people's heads.

It has been suggested that new knowledge always begins with the individual, and that making personal knowledge available to others is the central activity of the knowledge-creating company. The spiral knowledge model (Nonaka & Takeuchi, 1995) assumes that the process of sharing will result in the organisational amplification and exponential growth of working knowledge. Furthermore, it has been suggested that in order to build learning organisation the first step should be to foster an environment conducive to individual learning, that is allow experimentation and time to gain experience, and second, to open up boundaries and stimulate exchange of ideas (Garvin, 1998). Yet, little is known of the ways in which tacit knowledge is actually acquired and shared, conditions under which this occurs, and the impact it has on performance (Baxter & Chua, 1999).

It is important to recognise the value of knowledge and the need for better understanding of the potential of various knowledge-management initiatives to support knowledge creation. The main purpose of this study is help to provide an insight into two specific initiatives (opportunities for personal experience and social interaction) aimed at promoting individual knowledge in a decision-making context. Decision-making is regarded as a knowledge intensive activity. Decision-makers often gain knowledge of and ability to implement strategies on the task from experience gained through task repetition and from feedback. Their work also involves a significant amount of social interaction with their subordinates, peers and superiors. With the growing importance of fostering learning and sharing of personal knowledge in modern organisations it is of interest to examine two things in particular. Firstly, whether personal experience gained in iterative decision contexts may affect individual decision makers' working knowledge and what impact this may have on the quality of their subsequent decisions. Secondly, what effects might social interaction with other knowledge workers have on the quality of these same decisions.

PRIOR RESEARCH

The following review presents and discusses relevant past theoretical and empirical literature on the impact of personal experience and social interaction on various aspects of individual decision-making, and develops specific research questions of interest for the present study.

Personal Experience

Learning theorists suggest that people should learn from experience gained through task repetition and from feedback to adjust their behaviour and improve performance over time. In decision making, some authors (Payne et al., 1988) claim that adaptivity may be crucial enough to individuals that they would guide themselves to it without the need for an external prod. Other authors (Hogarth, 1981) believe that the availability of immediate feedback, in addition to the opportunity to take corrective action, is critical for effective learning. Adequate feedback is considered especially important for the correct assessment of the previous responses in situations where the subject is unfamiliar with the task or topic (O'Connor, 1989).

Empirical studies indicate mixed findings. Some studies reported modest learning from experience in a series of judgement tasks in which participants were provided with multiple pieces of information of varying accuracy at a cost (Connolly & Serre, 1984; Connolly & Gilani, 1982; Connolly & Thorn, 1987). Behavioural patterns of real participants were consistent with computer simulation and resulted in improved effectiveness with experience. Although the improvement was real, a serious deviation from optimality remained. In contrast, a study conducted in a similar multivariate judgement task reported no learning at all (Connolly & Wholey, 1988), while the results of a judgemental adjustment study (Lim & O'Connor, 1996) indicated that information strategy even worsened and consequently performance declined over time. Many studies performed in the multiple cue probability learning (MCPL) paradigm have concluded that people can not learn when multiple cues are involved or non-linear relationships exit (for review see Brehmer, 1980).

It has been suggested that feedback may enhance learning by providing an information about the task, task outcome, individual's performance and/or decision process. From this information, through task repetition, an individual may learn to adapt, ie. maintain, modify or abandon strategy to improve task performance. In his review of a number of laboratory and field studies on the impact of feedback on task performance, Kopelman (1986) reported that objective feedback (defined as information about task behaviour or performance that is factual and inconvertible), had a positive effect on performance. But it was stronger and more sizeable in the field than in laboratory. In choice task setting, Creyer et al. (1990) speculated that for an individual to adapt decision strategy to a particular decision task, he or she had to have at least some vague ideas about the degree of effort and accuracy characterising his or her decision process. They examined how decision-makers learned to adapt when presented with explicit accuracy feedback and/or explicit effort feedback. The results indicate that feedback on accuracy led to more normative-like processing of information and improved performance. The role of accuracy feedback was greater when the decision problem was more difficult. Explicit effort feedback, on the other hand, had no impact on processing or performance regardless of the difficulty of the problem.

In contrast, findings from MCPL studies with feedback reported by Klayman (1988) indicate that people have difficulties learning from outcome feedback in these tasks, but they can learn more effectively when they are provided with cognitive feedback, such as summary analysis of how their past predictions differed from optimal. Feedback was found to have induced learning in the so-called cue discovery tasks. People were found to perceive the existence and direction of a cue-criterion relation, but have difficulties in learning its shape. A significant improvement in predictive success over time was attributed to cue discovery rather than accurate weighting.

In a recent study examining the impact of several types of feedback on the accuracy of forecasts of time series with structural instabilities, Remus et al. (1996) found that task information feedback (showing the underlying structure of the task) with or without cognitive feedback (prompting on desirable behaviour) gave significantly better forecasting performance than the baseline simple outcome feedback. Adding cognitive information feedback to task information feedback did not improve forecasting accuracy. The study also found that performance outcome feedback (prompting with graphical indicator or words expressing levels of forecasting accuracy) was not superior to outcome feedback. The results for task and cognitive feedback largely replicated those by Balzer et al. (1992, 1994).

Some studies have found a detrimental effect of feedback on performance. In a complex probability task a large error on a particular trial might imply poor strategy or merely the fact that occasional errors are due to be expected in the probability task. As a consequence, outcome feedback may sometimes have a detrimental effect on strategy selection. Peterson and Pitz (1986) discovered that outcome feedback increased the amount by which the decision maker's estimates deviated from the model. Participants made predictions about a number of games won by a baseball team during the year on the basis of a number of performance indicators. These findings were further reinforced by Arkes et al. (1986) who found that the omission of feedback was effective in raising performance. Those without feedback relied more on helpful classification rule that enabled them to judge well in 70% of their decisions, than those with feedback who tried to outperform the rule and consequently performed worse.

In summary, findings concerning the impact of experience on decision performance in multivariate judgement tasks are mixed and inconclusive. The findings suggest that the quality of performance may be conditional upon the type of feedback, task difficulty, time period, and whether participants are allowed to experiment. Some theorists have suggested that "learning histories that capture past experiences may have a positive effect in terms of building of a better understanding about what works and what does not (Kleiner & Roth, 1998).

Social Interaction

Decisions in social environments can be made individually or in groups. The literature suggests that people make the majority of important personal decisions individually, but after significant social interaction (Heath & Gonzales, 1995). Individuals often seek to consult with others before deciding what jobs to take, what cars to buy, or what changes to make in their personal life. Managerial decision makers also follow similar interactive procedure when making business decisions. They collect information and opinions from their subordinates, peers and superiors, but make final decisions alone. Because they make their final decisions individually decision makers can use or ignore the information they collect during social interaction. In contrast, group decision making requires groups to reach a consensual decision.

The information exchange model of social process suggests that people interact primarily for the purpose of information collection. Situation-theoretic approach to interaction (Devlin, 1999) assumes that, for most conversations, the aim of each participant is to take new information about the focal object or situation into his or her context. The contextual situations can be represented graphically by ovals on a conversation diagram. The overlapping portions represent the contexts that the participants share. The interaction can be viewed geometrically as a gradual pushing together of the participants' contexts so that the overlapping portion becomes larger. Persuasive arguments perspective (Heath & Gonzales, 1995) assumes that an individual's position on any given issue will be a function of a number and persuasiveness of available arguments. It assumes that individuals come up with a few of arguments of their own, but during interaction they collect novel arguments and may shift their initial opinions. Group decision making approach recognises the collaborative nature of the interaction act and suggests the potential synergy associated with collaborative activity (Marakas, 1999). However, much of earlier research into group interactions questions the relative virtues ofcollaborative over individual decision making due to groupthink phenomenon. According to Janis (1982) members of the cohesive long-term groups strive for unanimity and do not realistically appraise alternative courses of action. This results in unfavourable outcomes.

It is argued that situations where individual decision makers interact in a social environment but make their own decisions should be free from groupthink-style outcomes. In such situations, interaction is assumed to allow individuals to more accurately assess their information and analysis, and improve individual decision performance. A small number of prior empirical studies investigating the issue indicate inconclusive findings. Heath and Gonzalez (1995) cited some earlier studies where interaction improved accuracy in general knowledge questions (Yates, 1991) and predictions domain (Hastie, 1986). However, their own research showed that individual performance did not improve much after interaction. Two studies on sport predictions showed that interaction did not increase decision accuracy or meta-knowledge (calibration and resolution), while one study found little responsiveness in risky shift dilemmas. Instead, interaction produced robust and consistent increases in people's confidence in their decisions. The authors offered a rationale construction explanation for their findings. It suggests that interaction forces people to explain choices to others and that explanation generation leads to increased confidence.

In contrast, Sniezek and Buckley (1995) reported mixed effects of interaction on individual performance within the judge-advisor system. In a given choice task concerning business events judges provided final team choices and confidence assessments independently or after being advised by two advisors. In particular, dependent judges made decisions as advised, cued judges made own decisions after being advised, and independent judges made initial decisions before and final decisions after being advised. Results showed that the effect of advice was dependent upon advisor conflict. With no-conflict, advice was generally beneficial. When conflict existed, it had either adverse (cued and Dependent) or no effect at all (independent) on judge's final accuracy.

In summary, interaction sometimes had positive, sometimes negative and sometimes no systematic effect on individual performance. The equivocal effects of interaction may be potentially attributed to differences in size of interacting groups, expertise and status of the participants, or the characteristics of the tasks involved. Some studies indicate that as the number of participants increases, the likelihood of discussing unshared information decreases (Stasser et al., 1989). According to recent studies on collaborative problem solving, teams of two people (dyads) are more successful than larger groups (Panko & Kinney, 1992; Schwartz, 1995). It has also been suggested that non-experts who are less informed about a decision problem should be more responsive to information collected and pooled through interaction (Heath & Gonzalez, 1995).

Study Focus

The focus of this study is to investigate the two variables of personal experience and social interaction. Specifically, the study will explore whether personal experience of the decision maker gained through task repetition with immediate feedback and from learning history affects individual decision accuracy in a judgemental decision making task. The study will also examine whether, and how, the opportunity for social interaction affects individual decision performance. Finally, it will test the potential interaction effects between personal experience and social interaction.

RESEARCH METHODOLOGY

Experimental Task

The experimental task in the current study was a simple production planning activity in which participants made decisions regarding daily production of fresh ice-cream. The participants assumed the role of Production Manager for a fictitious dairy firm that sold ice-cream from its outlet at Bondi Beach in Sydney, Australia. The fictitious company incurred equally costly losses if production were set too low (due to loss of market to the competition) or too high (by spoilage of unsold product). The participants' goal was to minimise the costs incurred by incorrect production decisions. During the experiment, participants were asked at the end of each day to set production quotas for ice-cream to be sold the following day. Before commencing the task, participants had an opportunity to make five trial decisions (for practice purposes only).

To aid their decision making, participants were provided with task relevant variables including actual local demand for product and three contextual factors that emerged as important in determining demand levels: the ambient air temperature, the amount of sunshine and the number of visitors/tourists at the beach. All contextual factors were deemed relatively similarly important. The task provided challenge because it did not stipulate exactly how information should be translated into specific judgement. The participants were provided with the meaningful task context, sequential historic information of task relevant variables to provide some cues to causal relationship, and forecast values of contextual variables to suggest future behaviour. However, they were not given any explicit analysis of the quality of their information, or rules they could apply to integrate the available factual information.

Instead, all participants had an opportunity to learn from own experience through task repetition and from performance history. Each participant was required to make thirty experimental production decisions over a period of thirty consecutive simulated days. While handling the task, different participants had different opportunity for social interaction with others. One half of the participants was required to make decisions independently, without any interaction with others. The other half was encouraged to share their information and opinions. More specifically, participants from this group were placed in groups of two and instructed to discuss their information and opinions before making their final decisions. However, they were not required to reach a consensual decision.

At the beginning of the experiment, task descriptions were provided to inform participants about the task scenario and requirements. The given text differed with respect to the form of communication allowed. In addition, throughout the experiment instructions and immediate performance feedback as well as the history of past errors were provided to each participant to analyse earlier performance and to adjust future strategies.

Experimental Design and Variables

A laboratory experiment with random assignment to treatment groups was used, since it allowed greater experimental control. This made it possible to draw stronger inferences about causal relationships between variables due to high controllability. Independent variables were (i) *personal experience* (earlier phase vs later phase) and (ii) *social interaction* (constrained interaction vs encouraged interaction).

In order to explore learning from personal experience, experimental trials were divided into two blocks of trials referred to as phases. Each phase was equivalent to a block of fifteen trials. Block 1 (or earlier phase) consisted of subjects' first 15 trials, while block 2 (or later phase) consisted of their last 15 trials. Social interaction was manipulated by completely constraining or maximally encouraging (through dialogue) sharing of ideas and information during decision making.

Decision performance was evaluated in terms of decision accuracy operationalised by *absolute error* (AE) and *symmetric absolute percentage error* (SAPE). Absolute error was calculated as an absolute difference between the units of sales produced and the units of the product actually demanded (in hundreds of sale units). Symmetric absolute percentage error was obtained by further dividing the absolute error by an average of produced and demanded values and multiplying by 100%. These measures have been suggested by forecasting literature (Makridakis & Wheelwright, 1989; Makridakis, 1993). Percentage error is generally preferred to absolute error because it controls for scale.

Participants and Procedure

The participants were 28 graduate students enrolled in the Master of Commerce course at The University of New South Wales, Sydney. Students participated in the experiment on a voluntary basis and received no monetary incentives for their performance. Generally, graduate students are considered to be appropriate participants for this type of research (Ashton & Kramer, 1980; Remus, 1996; Whitecotton, 1996). The experiment was conducted in a microcomputer laboratory. On arrival, participants were assigned randomly to one of the treatment groups by picking up a diskette with an appropriate version of the research instrument. The instrument was specifically developed by one of the authors in Visual Basic. Students were briefed about the purpose of the study, read case descriptions and performed the task. The session lasted about one hour.

RESULTS

The impact of personal experience and social interaction on individual performance was analysed statistically using the T-test method. A series of tests were performed to examine simple main effects of independent factors on two performance measures (absolute error and percentage error). Results are presented in Tables 1 and 2.

TABLE 1
PERSONAL EXPERIENCE EFFECTS

Social Interaction	Constrained				Encouraged			
Personal Experience	Earlier (N=210)	Later (N=210)			Earlier (N=210)	Later (N=210)		
Dependent Variable	Mean (std)	Mean (std)	t	p	Mean (std)	Mean (std)	t	p
Absolute Error ('00)	4.06 (4.20)	3.62 (4.01)	1.10	.273	3.38 (3.23)	2.33 (2.00)	4.01	.000**
Percentage Error (%)	19.25(25.16)	16.36 (21.59)	1.27	.207	13.56 (11.25)	9.28 (8.24)	4.45	.000**

* p < 1.00 ** p < .05

TABLE 2
SOCIAL INTERACTION EFFECTS

Personal Experience	Earlier				Later			
Social Interaction	Constrained (N=210)	Encouraged (N=210)			Constrained (N=210)	Encouraged (N=210)		
Dependent Variable	Mean (std)	Mean (std)	t	p	Mean (std)	Mean (std)	t	p
Absolute Error ('00)	4.06 (4.20)	3.38 (3.23)	1.87	.062*	3.62 (4.01)	2.33 (2.00)	4.20	.000**
Percentage Error (%)	19.25(25.16)	13.56 (11.25)	2.99	.003**	16.36 (21.59)	9.28 (8.24)	4.44	.000**

* p < 1.00 ** p < .05

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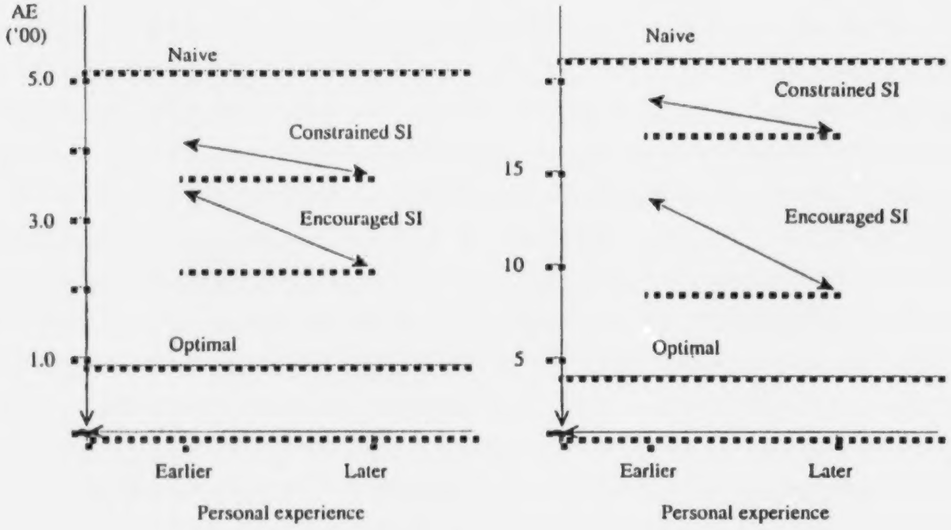
With respect to personal experience, results of the analyses performed indicate mixed effects. In particular, Table 1 shows no significant impact of experience on individual performance in a constrained interaction condition. Although participants' decision errors tended to decrease slightly from earlier to later phase, the change was not statistically significant in either mean absolute error (4.06 vs 3.62, ns) or percentage error (19.25 vs 16.36, ns). On the other hand, Table 1 shows a significant positive effect of increased level of experience on individual performance in the encouraged social interaction condition. There was a significant decrease in participants' decision errors from earlier to later phase both in terms of absolute error (3.38 vs 2.33, t=4.01, p< .05) and percentage error (13.56 vs 9.28, t=4.45, p< .05). The results indicate that participants tended to learn over time and improve performance when encouraged to interact with others.

With respect to the simple effects of social interaction, results of the analyses performed indicate that interaction with others had a substantial beneficial impact on participants' performance irrespective of experience. Table 2 reveals significant positive effects of social interaction on decision errors in both earlier and later phases. The mean absolute error of the participants in the encouraged interaction group was significantly smaller than that of their counterparts in the constrained interaction group in earlier (3.38 vs 4.06, t=1.87, p<1.00), as well as later (2.33 vs 3.62, t=4.20. p<.05) period. Similarly, the participants in the encouraged interaction group had significantly smaller percentage errors than their counterparts in the constrained interaction group, both in earlier (13.56 vs 19.25, t=2.99, p<.05) and later (9.28 vs 16.36, t=4.44, p<.05) phases of the task.

Results of the analysis performed are further presented graphically in Figure 1. In addition to error scores of actual participants by experimental conditions, the figure also includes the corresponding errors of notional naive and optimal decision makers. These are error scores that would have been obtained by people who produced their decisions by using naive and optimal strategies for task performance. These scores were used to assess how much of the theoretically possible potential of information to improve performance was used by the actual participants.

FIGURE 1
INDIVIDUAL DECISION PERFORMANCE BY PERSONAL EXPERIENCE



The analysis shows a significant difference in the mean absolute error scores between actual participants and notional naives (4.06 vs 5.18, t=2.99, p< .05) in the earlier phase and constrained interaction condition. There was also a slight, but not significant difference in the mean percentage error scores (21.68 vs. 19.25, t=1.23, ns). The participants tended to make smaller than naive decision errors as a result of using some of the potential of their available information to improve performance irrespective of experience and interaction condition.

The analysis further shows a significant difference in the mean absolute error scores between actual participants and notional optimals (2.33 vs 0.87, t=9.87, p< .05) in the later phase and encouraged interaction condition. There was also a significant difference in the mean percentage error scores (9.28 vs 3.56, t=9.31, p< .05). The participants tended to make significantly greater decision errors than they theoretically could have with the available information, irrespective of experience and interaction condition.

DISCUSSION

The findings of this study provide qualified support for the proposition that a knowledge management initiative such as providing an opportunity for independent experiential learning will enhance individual working knowledge and improve performance in a non-deterministic decision making task context. Beneficial effect of greater experience was evident only in the interactive environment. A knowledge management initiative aimed at encouraging information sharing through social interaction was usefulness and enhanced performance irrespective of experience.

With respect to personal experience, the findings of the current study indicate that its impact on performance was contingent upon social interaction. Contrary to theoretical expectations, the current study found no significant improvement in individual performance with experience in the non-interactive environment. Although participants in the non-interactive group tended to make slightly smaller decision errors in the later than in the earlier phase of the task, the change was not statistically significant. The lack of significant learning and performance improvement found in the non-interactive decision making environment is not surprising. It is consistent with a large body of knowledge accumulated from judgement and decision making research involving non-deterministic multi-variate tasks with or without feedback (for review see Brehmer, 1980).

It seems that the history of past errors expected to help learning (Kleiner & Roth, 1998) could not provide the participants with the information as to what works and what does not in the context of a non-deterministic task. The same decision error could be produced by many different misapprehensions about the relations between the task variables. According to Brehmer (1980) people can not learn probabilistic relations because they assume that the variables are related by deterministic rule. However, the fact that the participants responded in the appropriate direction suggests that they could potentially achieve significant improvement if given more trials. The results from the cue discovery tasks (Klayman, 1988) indicate that it was possible to accomplish cue discovery gradually over a larger number of trials (ranging into the hundreds).

Contrary to most previous research, the current study has demonstrated a substantial beneficial effect of increased experience on decision accuracy in the interactive decision making environment. Participants who interacted with others while handling the decision problem tended to exhibit significant learning over time which led to improved quality of their decisions. This was demonstrated by significantly smaller absolute and percentage errors found among these participants in the later than in the earlier period of the task This is an important finding. It suggests that social interaction enhanced learning. These participants were able to learn better how to use their available information to improve performance. As a result, they tended to make more accurate decisions. It is possible that the opportunity to discuss various aspects of the task with others helped the participants better assess the quality of the available information and evaluate their tentative prediction strategies. It could also help them perceive the task as less complex.

Indeed, the current study has demonstrated that social interaction had a beneficial effect on individual performance irrespective of experience. More specifically, encouraged social interaction led to improved decision accuracy in both earlier and later stages of the task. When participants were allowed to interact and share ideas with others while handling the decision problem, they were found to make smaller decision errors (absolute and percentage) than when they performed the same task without such interaction. This was true in both less and more experienced stages of the task.

The beneficial effect of social interaction evident in this study is consistent with the theoretical expectations suggested by the knowledge management literature (Garvin, 1998; Nonaka & Takeuchi, 1995). It also agrees with numerous anecdotal evidence from the real world organisations (Hewson, 1999). However, the results obtained in this study contradict findings by Heath and Gonzalez (1995) who investigated the issue in the similarly complex predictive task domain in study 2. The difference between the two findings can be potentially attributed to the characteristics of the task context in which the investigation was carried out. Different from Heath and Gonzalez, the current study provided participants with immediate performance feedback. Earlier empirical research indicated beneficial effect of feedback on learning (Kopelman, 1986).

Participants might have brought their personal analysis and know-how to the task, acquired information about their partner's ideas and arguments and considered both in making final decisions. Immediate performance feedback might have enabled participants to evaluate their own ideas against those of their partners or jointly generated ones, and adjust future strategies accordingly. Generating and sharing personal tacit knowledge through interaction coupled with the opportunity to test its contribution to performance over time might have enhanced learning and resulted in greater accuracy.

The current study also tried to avoid a potential adverse effect of advisor-conflict by limiting individual's social interaction to one other person. Sniezek and Buckley (1995) reported that in a two-advisor system with conflict, advice did not improve judge's accuracy and resulted in deteriorated performance in some cases. In addition, the participants in the current study had dual judge-advisor roles. Because of their equal status in the interactive act, it is possible that the participants jointly generated some new ideas previously non-existent in their individual contexts. Previous research indicated that teams of two people were successful in performing collaborative activities (Panko & Kinney, 1992; Schwartz, 1995).

With respect to overall performance, the study revealed significant improvement in decision accuracy over naive strategy across all treatments. This was demonstrated by significantly smaller decision errors found among actual participants than their notional naive counterparts. The results suggest that people need very little experience (eg. just an initial short practice) with the task to be able to recognise relevant and valid information as such. As a result they are able to use some of its potential to improve performance. This agrees with some earlier findings (Klayman, 1988) indicating that while people have difficulties in learning its shape, they are generally able to perceive the existence and direction of a cue-criterion relation.

Unfortunately, the study revealed significant deviations from optimal performance across all treatments. Participants tended to use much less of full information potential and perform much worse than they could have. This was demonstrated by significantly greater decision errors found among actual participants than their notional optimal counterparts. The suboptimal overall performance could be potentially attributed to the lack of monetary incentives. Sniezek and Buckley (1995) provided their students with substantial monetary rewards for their performance. It is possible that without monetary incentives, the participants did not try as hard as possible to use more potential of their information to improve decisions. By not giving extrinsic incentives, this study attempted to prevent information "hoarding , and promote cooperation rather than competition among the participants. It was also assumed that graduates chosen from the pool of students attending an advanced level course should be motivated to do their best on the task by the intrinsic interest for the subject matter.

Alternatively, the failure to achieve optimal performance could be attributed to the characteristics of the task information. Information repositories available to participants in the current study contained only factual information with little analysis, and had no procedural information. Acquiring "explicit factual knowledge was not sufficient to perform well on the task. The participants needed also analytical information such as evaluation of predictive validity of each contextual factor, as well as the relevant know-how to integrate factual information into a decision response. This crucial information was assumed to be a part of individual "tacit knowledge acquired from experience and social interaction. However, it is possible that non-expert participants needed to either interact with experts or be given more time to develop higher levels of the required "tacit knowledge to perform well on the task.

While the current study provides a number of interesting findings, some caution is necessary regarding their generalisability due to a number of limiting aspects. One of the limitations refers to the use of a laboratory experiment that may compromise external validity of research. Another limitation relates to artificial generation of information that may not reflect the true nature of real business. The participants chosen for the study were students and not real life decision makers. The fact that they were mature graduates may mitigate the potential differences. No incentives were offered to the participants for their effort in the study. Consequently, they could find the study tiring and unimportant and would not try as hard as possible. Most decisions in real business settings have significant consequences.

Although limited, the findings of the current study may have some important implications for organisational knowledge management strategies. They indicate that novice knowledge workers left on their own in working environments that do not encourage culture of sharing are not likely to learn effectively from experience (beyond the initial learning through short practice) and are not likely to further improve performance. Creating working contexts that encourage communication and culture of information sharing among knowledge workers may potentially have a beneficial effect on knowledge creation by speeding up individual learning and resulting in enhanced performance. The findings may also have some important pedagogical implications for distance education, given the growing number of distance learning programmes offered by various university colleges and business schools. In particular, the evidence from this study suggests that support facilities such as groupware systems may be necessary to enable interaction among distance learners to augment their individual experience.

CONCLUSIONS

The main objective of this study was to investigate the effects of personal experience and social interaction on people's working knowledge and use of that knowledge to improve performance in a specific decision making context. In summary, the findings of the study indicate that increased experience did not result in significant performance improvement of individual decision makers when no opportunity for interaction with others was available. In the interactive environment, increased experience led to enhanced decision accuracy. The findings further indicate a beneficial effect of social interaction on performance irrespective of decision makers' experience. The encouraged social interaction was useful at both low and high experience stages of the task and resulted in enhanced decision accuracy when compared to constrained interaction. These findings may have important implications for knowledge management, as they reveal synergy of the two combined factors in effective knowledge creation and subsequent performance improvements. Further research is required that would extend the study to other participants and environmental conditions in order to ensure the generalisability of the present findings.

REFERENCES

Arkes, H.R., Dawes, R.M. & Christensen, C. (1986). Factors Influencing the Use of a Decision Rule in a Probabilistic Task. *Organisational Behaviour and Human Decision Processes*, 37, 93-110.

Arthur Andersen Office of Training and Education (AAOTE) (1998). *BC Knowledge Management*. Arthur Andersen.

Ashton, R.H. & Kramer, S.S. (1980). Students as Surrogates in Behavioural Accounting Research: Some Evidence. *Journal of Accounting Research*, 18(1), 1-15.

Balzer, W.K., Hammer, L.B., Sumner, K.E., Birchenough, T.R., Martens, S.P. & Raymark, P.H. (1994). Effects of Cognitive Feedback Components, Display Format, and Elaboration on Performance. *Organisational Behaviour and Human Decision Processes*, 58, 369-385.

Balzer, W.K., Sulsky L.M., Hammer, L.B. & Sumner, K.E. (1992). Task Information, Cognitive Information, or Functional Validity Information: Which Components of Cognitive Feedback Affect Performance? *Organisational Behaviour and Human Decision Processes*, 58, 369-385.

Baxter, J. & Chua, W.F. (1999). Now and the Future. *Australian Accounting Review*, 9(3), 3-14.

Brehmer, B. (1980). In One Word: Not from Experience. *Acta Psychologica*, 45, 223-241.

Connolly, T. & Gilani, N. (1982). Information Search in Judgement Tasks: A Regression Model and Some Preliminary Findings. *Organisational Behaviour and Human Performance*, 30, 330-350.

Connolly, T. & Serre, P. (1984). Information Search in Judgement Tasks: The Effects of Unequal Cue Validity and Cost. *Organisational Behaviour and Human Performance*, 34, 387-401.

Connolly, T. & Thorn, B.K. (1987). Predecisional Information Acquisition: Effects of Task Variables on Suboptimal Search Strategies. *Organisational Behaviour and Human Decision Processes*, 39, 397-416.

Connolly, T. & Wholey, D.R. (1988). Information Mispurchase in Judgement Tasks: A Task Driven Causal Mechanism. *Organisational Behaviour and Human Decision Processes*, 42, 75-87.

Creyer, E.H., Bettman, J.R. & Payne, J.W. (1990). The Impact of Accuracy and Effort Feedback and Goals on Adaptive Decision Behaviour. *Journal of Behavioural Decision Making*, 3(1), 1-16.

Davenport, T.H. & Prusak, L. (1998). *Working Knowledge*. Boston: Harvard Business School Press.

Davenport, T.H., DeLong, D.W. & Breers, M.C. (1998). Successful Knowledge Management Projects. *Sloan Management Review*, Winter, 43-57.

Devlin, K. (1999). *Infosense: Turning Information into Knowledge*. New York: W.H. Freeman and Company.

Drucker, P.F. (1993). *Post-Capitalist Society*. New York: Harper Business.

Drucker, P.F. (1998). The Coming of the New Organisation. *Harvard Business Review on Knowledge Management*, Boston: Harvard Business School Press.

Garvin, D.A. (1998). Building a Learning Organisation. *Harvard Business Review on Knowledge Management*. Boston: Harvard Business School Press.

Grayson, C.J. & Dell, C.O. (1998). Mining Your Hidden Resources. *Across the Board*, 35(4), 23-28.

Hastie, R. (1986). Experimental Evidence on Group Accuracy. In Grofman B. & Owen G. (eds) *Decision Research*, 2, 129-157.

Heath, C. & Gonzalez, R. (1995). Interaction with Others Increases Decision Confidence but Not Decision Quality: Evidence against Information Collection Views of Interactive Decision Making. *Organisational Behaviour and Human Decision Processes*, 61(3), 305-326.

Hewson, D. (1999). Start Talking and Get to Work. *Business Life*, November, 72-76.

Hogarth, R.M. (1981). Beyond Discrete Biases: Functional and Dysfunctional Aspects of Judgemental Heuristics. *Psychological Bulletin*, 90(2), 197-217.

Janis, I (1982). *Groupthink: Psychological Studies of Policy Decisions and Fiascoes*. Boston: Houghton-Miffin.

Klayman, J. (1988). Learning from Experience. In Brehmer, B. & Joyce, C.R.B. (eds) *Human Judgement. The SJT View*. Amsterdam: North-Holland.

Kleiner, A. & Roth, G. (1998). How to Make Experience Your Company's Best Teacher. *Harvard Business Review on Knowledge Management*. Boston: Harvard Business School Press.

Kopelman, R.E. (1986). Objective Feedback. In Locke, E.A. (ed) *Generalising from Laboratory to Field Settings*. Lexington Books.

Lim, J.S. & O'Connor, M.J. (1996). Judgemental Forecasting with Interactive Forecasting Support Systems. *Decision Support Systems*, 16, 339-357.

Makridakis, S. (1993). Accuracy measures: theoretical and practical concerns. *International Journal of Forecasting*, 9, 527-529.

Makridakis, S. & Wheelwright, S.C. (1989). *Forecasting Methods for Management*, 5th ed. New York: John Wiley and Sons.

Marakas, G.M. (1999). *Decision Support Systems in the 21st Century*. New Jersey: Prentice Hall Inc.

Nonaka, I. (1998). The Knowledge-Creating Company. *Harvard Business Review on Knowledge Management*. Boston: Harvard Business School Press.

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

O'Connor, M.J. (1989). Models of Human Behaviour and Confidence in Judgement: A Review. *International Journal of Forecasting*, 5, 159-169.

Panko, R. & Kinney, S. (1992). Dyadic Organisation Communication: Is the Dyad Different? *Proceedings of the 25th Hawaii International Conference on Systems Sciences*, 244-253.

Payne, J.W., Bettman, J.R. & Johnson, E.J. (1988). Adaptive Strategy Selection in Decision Making. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 14(3), 534-552.

Peterson, D.K. & Pitz, G.F. (1988). Confidence, Uncertainty and the Use of Information. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 14, 85-92.

Remus, W. (1996). Will Behavioural Research on Managerial Decision Making Generalise to Managers? *Managerial and Decision Economics*, 17, 93-101.

Remus, W., O'Connor, M. & Griggs, K. (1996). *Does Feedback Improve the Accuracy of Recurrent Judgemental Forecasts*. Working paper, University of Hawaii, January.

Sauer, C. (1993). *Why Information Systems Fail: A Case Study Approach*. Henley-on-Thames: Alfred Waller.

Schwartz, D. (1995). The Emergence of abstract representation in dyad problem solving. *The Journal of the Learning Sciences*, 4(3), 321-345.

Senge, P. (1990). *The Fifth Discipline*. New York: Double-day.

Sniezek, J.A & Buckley, T (1995). Cueing and Cognitive Conflict in Judge-Advisor Decision Making. *Organisational Behaviour and Human Decision Processes*, 62(2), 159-174.

Stasser, G., Taylor, L.A., & Hanna, C. (1989). Information Sampling in Structured and Unstructured discussions of three- and six-person groups. *Journal of Personality and Social Psychology*, 57, 67-68.

Stewart, T.A. (1997). *Intellectual Capital: The New Wealth of Organisations*. New York: Doubleday.

Swanson, E.B. (1988). *Information Systems Implementation*. Homewood: Irwin.

Whitecotton, S.M. (1996). The Effects of Experience and a Decision Aid on the Slope, Scatter, and Bias of Earnings Forecasts. *Organisational Behaviour and Human Decision Processes*, 66(1), 111-121.

Yates, J.F. (1991). *JDM conference presentation*. November, San Francisco.

THE LEARNING EFFECTIVENESS OF INSTRUCTIONAL TECHNOLOGIES: RESULTS FROM PILOT STUDIES

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ABSTRACT

This paper responds to calls for further research on learning effectiveness of instructional technologies by comparing 'learning' and 'attitudes' across three instructional environments (multimedia, textbook and in-class instruction), and proposing a quasi-experimental research design approach. The paper reports the results of pilot studies conducted with the aim of refining the research framework, assessing the experimental conditions, and obtaining preliminary results. This research framework and the pilot studies are described.

INTRODUCTION

Since technology is so widespread in society, different stakeholders believe that educational strategies should reflect this expanding phenomenon by introducing instructional technology in the classroom. They often assume that the effectiveness of technology has been proven once and for all (Roblyer et al, 1997). Instead, the learning effectiveness of instructional technology is yet to be proven. In spite of the several studies (Nugent, 1982; Mayer & Anderson,1991) and meta-analyses (Kulik, Kulik & Shwalb, 1986; Roblyer, Castine & King, 1988; Kulik, 1994; Khalili & Shashaani, 1994;) competing to answer the question: "do computers and other related technologies make a difference in learning? the question on the comparative performance of instructional technology is not yet answered. Several scholars are calling for further research (Liao, 1998; Jones & Paolucci, 1998; Fletcher-Flinn & Gravatt, 1995).

The authors try to answer the call for further research with a quasi-experimental design which compares 'learning' and 'attitudes' (satisfaction and appeal) in subjects gaining knowledge of project management topics by either attending a class presentation, reading a textbook, or using an interactive multimedia CD-ROM. The subjects of the study are graduate and undergraduate students enrolled in business administration degree programs at a major East-coast University. The study is replicated, under comparable conditions, with the two groups. The purpose of the replication is to explore whether learning effectiveness and satisfaction vary by age (graduate and undergraduate), and by subject topic characteristics.

Because the results from the implementation of the quasi-experiment are not available at the present time, this paper focuses in describing the theoretical framework, the research design, and the results of the pilot studies that precede the actual testing. The results from the analysis will be available in December 2000.

THE LEARNING EFFECTIVENESS OF INTERACTIVE MULTIMEDIA SYSTEMS

The authors' expectations based on the literature review is that the instructional conditions that best support multiple representation modes have a higher impact on learning specific content. Instructional technologies such as interactive multimedia allow the integration of multiple media in a specific delivery environment, therefore promoting multiple representations of knowledge. The structural features (organization of content, modes of delivery) of interactive multimedia have an impact in the construction of mental models (Jonassen, 1990) and, particularly, a positive effect on the cognitive system.

Tergan (1997) states that the cognitive processing of multiple external representations (such as the ones in interactive multimedia and hypermedia) matches principles of encoding variability and encoding specificity (Tulving, 1983). The *encoding specificity* principle requires that learning situations contain recognizable clues that help learners understand, locate, and recall information; and that realistic contexts (like the ones in interactive multimedia systems) generally result in better performance. The principle of *encoding variability* is also supported by interactive mltimedia multiple representation modes. The fact that information is encoded in a variety of formats increases the chances that at least one of the representations corresponds to the context of use in a particular situation (Hammond, 1993).

The value of interactive multimedia learning is also supported by the principles of cognitive flexibility theory (Jacobson & Spiro, 1995); multimodal cognitive processing (Cuninhgham et al., 1993); and individualized and self-regulated instruction (Duffy & Knuth, 1990). According to the *cognitive flexibility theory*, interactive multimedia environments employ multiple ways to represent knowledge in instructional activities, thus reflecting the nature of complex knowledge. This contributes to the development of cognitive structures that are flexible enough to be applicable to different contexts, enhancing knowledge transfer. Paivio (1986) finds that using visuals and other representational modes entails *dual coding*, which enables humans to better retain information. Paivio's theory is supported by recent developments of multimedia approaches to learning (Engelkamp & Zimmer, 1994). Remembering, for example, may be enhanced because information is represented in different cognitive systems.

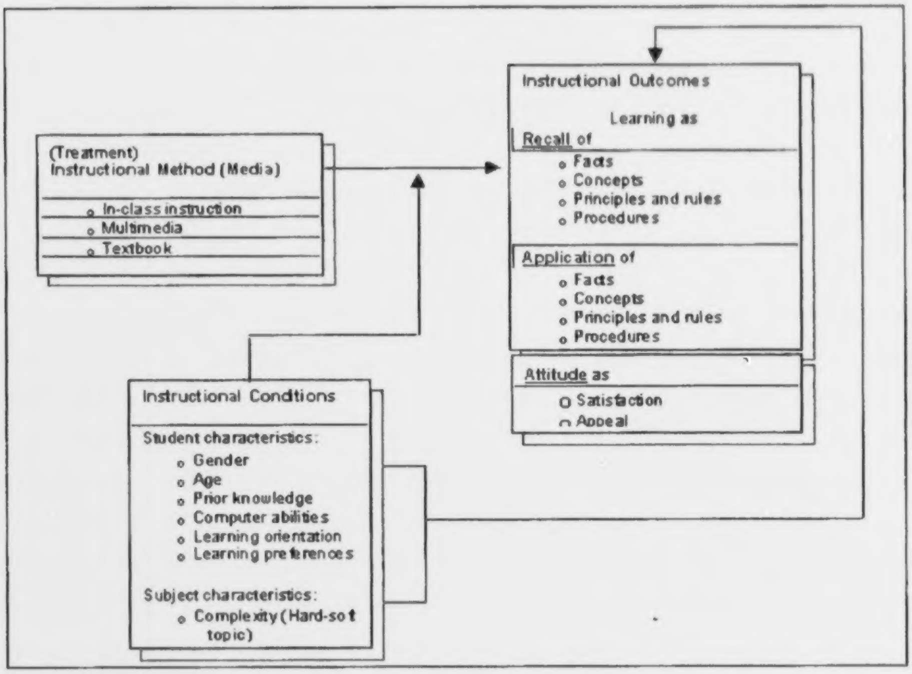
The learning effectiveness argument for multimedia is also supported by the *multiple intelligences theory* (Gardner, 1984, 1993) and *emotional intelligence theory* (Goleman, 1995). Multiple symbolic modes promote synergistic interactions among several intelligences (spatial, kinesthetic, logical-mathematical, musical, linguistic, interpersonal, intrapersonal) and benefit learning in the various domains - cognitive, affective, psychomotor - (Kemp, 1994). Computer-based media support the social dimensions of human learning, interpersonal and intrapersonal intelligences, to an astonishing degree (McLellan, 1996).

By affecting different domains (cognitive, affective and psychomotor) multimedia also allows mass-customization of instruction, since instruction offered in several modes is adaptable to the individual learner. Different learners are more attuned to different types of representations (Keller, 1983) and implementing reinforcing activities may enable them to "explicitly or "implicitly select the activity that is most "customized to their cognitive skills (McLellan, 1996). In addition, by shifting between different representations, learners get multiple practice (Marks-Tarlow, 1995).

RESEARCH DESIGN

In this framework, the main question of the researchers is '*Whether interactive multimedia applications are effective learning tools compared to traditional learning environments (textbook, or in-class instruction).*' To test the learning effectiveness of interactive multimedia, this study adopts the definition of learning in Merrill's performance-content matrix model (1983). Based on this definition, the *independent variables'* (the three instructional settings, such as the class presentation, the textbook, and the multimedia CD-ROM) effects on the learning of project management topics (*dependent variable*) are examined through comparing subjects' recall and application performance in specific content areas (recall and application of facts, concepts, principles, and procedures). Subjects' attitudes (*dependent variable*) across the instructional settings are investigated through learners' comparative satisfaction with the instructional materials (see *Figure 1*).

FIGURE 1
QUASI-EXPERIMENTAL MODEL FOR TESTING THE COMPARATIVE EFFECTIVENESS OF INSTRUCTIONAL TECHNOLOGIES



The *intervening variables* include: *student characteristics* such as gender, age, prior knowledge, computer abilities, and learning preferences; and, *subject characteristics*, such as complexity of the topic (high and low complexity). Assessing learners' prior knowledge of the topic and reporting their demographic breakdown reinforces the research design. It enables comparing and contrasting the treatment and control groups, as well as developing a better understanding of the characteristics of the students surveyed.

Because the effectiveness of the instructional materials may also depend on learners' prior experience in management, the study utilizes a pre-test & posttest design to assess learners prior knowledge of the topic. In addition, the demographic survey collects data on learners prior work experience (see, for example, *Figure 2*), major, and computer utilization.

Related questions associated to the model presented in Figure 1 and based on Merrill's (1983) performance-content matrix include:

Which environment is more effective at achieving learning objectives (recall or application)?

Which environment is more effective at delivering a specific type of topic (with high/low complexity)?

Which environment, if any, is more appealing for the learners' groups (graduate, undergraduate) targeted?

The responses to these questions based on the implementation of the study will be available in December 2000. Although it is expected that it will be difficult to make clear-cut and distinct statements on the instructional effectiveness of technology (interactive multimedia may be more effective for specific content areas, such as recall of facts and principles, but less effective in applications of procedures), the authors set up a study that tries to overcome the limitations recognized in earlier studies.

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DIFFICULTIES AND REMEDIES

There are many factors that can influence the results of effectiveness studies. The researchers recognize the difficulty and address the objections brought to similar comparative learning research. In particular, Clark (1983) offered many objections to the value of the analyses that claimed comparatively positive outcomes in educational technologies. According to Clark (1983) the most common sources of confounding evidence in earlier studies appeared to be the uncontrolled effects of: *a)* instructional method or content differences between treatments that are compared; and *b)* novelty effect for newer media, which tends to disappear over time.

1. The research design of this study addresses Clark's considerations and tries to isolate learning from the medium by limiting the instructional time, controlling the learning environment, and assessing the role of intervening variables.

2. To address Clark's first concern (point *a*), the researchers focus on *one* specific technology (multimedia) and compare its effectiveness with both classroom and text-based instruction in teaching project management modules using the *same* teaching materials. The characteristics of the instructional material are briefly described to provide support to the comparability statement.

The Textbooks

The textbooks from which the multimedia CD-ROM, and the in-class instruction, are based are two major project management publications.

> Frame (1994) The New Project Management: Tools for an Age of Rapid Change, Corporate Reengineering, and Other Business Realities. The Jossey-Bass Management Series
>
> Frame (1995) Managing Projects in Organizations: How to Make the Best Use of Time, Techniques, and People. The Jossey-Bass Management Series

Both publications are ranked highly (number of sales, and reviewers' comments) in the project management literature. They both present similar design and layout features, and they both address complementary topics. They use diagrams and drawings to reinforce understanding, offer several examples, and occasionally include mini-case studies to foster reflection and application. The case studies present problems, and solutions, to emulate a mechanism of feedback provision.

The multimedia CD-ROM

The 'Project Management in Organizations (PMO) CD-ROM' is the multimedia version of Frame, 1994 & Frame, 1995. The CD-ROM closely follows the books' organization: learning units mirror chapter titles and structure. The application is designed to teach the fundamentals of project management. Audiences vary from aspiring project managers, project team members, executives, or other stakeholders interested in learning project management.

The CD-ROM provides a stand-alone tool for learning project management introductory topics and is copyrighted by the Education Services Institute - ESI-International, 1997. It includes different media formats and features:

full motion video
audio files
text-based animation
extensive interactivity (with case studies and other exercises)
high-quality graphics
user-friendly navigation interface

It also offers a Toolbox with examples of tools, access to Resources (calculator, glossary, notepad), and an Organizer, to sort information in the program, and access testing.

In-class instruction

The lecture presentations by J. Davidson Frame are supported by the use of overhead transparencies. The transparencies follow the organization of Frame, 1994, 1995. They display the graphical images of the textbook, and develop additional graphical representations. The instructor primarily uses markers to write on transparencies during the presentation. Occasionally, display boards are used to support explanations.

The instructor offers several examples, asks frequent questions to the audience, provides feedback to responses, and encourages participation through in-class discussion of section problems. Frequently, cases and other exercises are completed in-class, with the instructor support.

3. The study does not address the issue of "novelty. Clark's point *b)* suggests that the use of technology has an initial positive impact on learning, but this impact is lowered over time (what Clark calls "*novelty* effect). Clark himself (Clark & Sugrue, 1995) reports that some studies on the use of computers in college (Kulik & Kulik, 1980) did not find any evidence for the novelty effect. Kulik and Kulik's comparisons of studies of one or two hours duration, vs. studies which held weekly sessions for an entire semester, reported that the effect sizes on learning were roughly the same. Clark responds to these findings by pointing to the fact that the use of computers may be a less "novel experience for college students than for other younger students (p.354).

Because the subjects of this research are college students, following Kuliks' findings and Clark's own considerations, this study limits the length of the instructional modules to short-segments of instruction (from 1 hour and 15 minutes to 2 hours of instruction). Moreover, the limited length of the instructional modules enables focusing on the impact of the medium on achievement and satisfaction rate by eliminating competing variables (such as "total study time) that studies with delayed post-testing may introduce. The researchers recognize that the use of short-instructional modules introduces some limitations regarding the types of knowledge and performance tasks that are achievable within the limited timeframe.

METHODOLOGY AND FOCUS REFINEMENT THROUGH PILOT STUDIES

Three pilot studies precede the refinement of both the theoretical framework and the procedures described in this study. They are valuable elements of the quasi-experimental approach and are, therefore, reported in this paper.

Research Methodology Refinement – Pilot Study (1)

A first pilot study has been instrumental to refine the methodological approach (and deciding between a short-term approach vs. a longer-term study). The researchers' aim to exploit the advantages of the media by offering participants the opportunity to use the textbook/s, or the CD-ROM at their own timing, outside of a laboratory environment, and with little control of the instructional conditions has been prevented by a high-mortality rate.

The sample population for this first pilot designed to assess the feasibility of a long-term self-paced study was composed of working professionals registered to monthly workshops in Project Management offered by a major project management educational services institution in the US. Individuals registered to the workshop received an invitation to participate in the study. Volunteers were randomly assigned to two treatments (interactive multimedia CD-ROM or textbook-instruction). Individuals registered in the workshop were assigned to the lecture treatment. They completed paper-and-pencil surveys. Volunteers in the other treatment groups took all the surveys on-line.

The outcomes of this pilot study supported the need of controlling for instructional conditions, thus undertaking the study in a real-laboratory setting. Although interactive multimedia applications are designed to support self-paced instruction, learners need to receive constant reinforcement and feedback to complete the training program. Although over 23% of the 100-individuals contacted volunteered their participation, 13% dropped prior to receiving the instructional materials. Of the remaining 10% who received the instructional materials, only 5 people completed the study on time (prior to their scheduled training session). The high mortality rate has been instrumental in redesigning the research to test, only in a controlled setting, graduate and undergraduate groups enrolled in business administration degree programs.

Demographic Sample – Pilot Study (2)

Another pilot study was conducted with the objective of testing scale reliability and assesses the comparability of MBA-Cohort groups. The pilot was held during the laboratory sessions of two sections of an MBA-Cohort Information System course. Students enrolled in

Tuesday and Wednesday's laboratory sessions (hereafter referred to as Tuesday, or Wednesday students) took an on-line questionnaire on project management topics ranging from Time Management, Cost Management, Human Resources Management, Risk Management, Communication Management, and Scope Management. They also completed a demographic survey.

The purpose of the demographic survey was to compare the characteristics of the Tuesday and Wednesday groups to identify any specific group composition bias, which could inhibit the generalizability of the findings, and caution against the use of the scale in the actual study. The demographic data evaluated group variances. The frequency results of the demographic surveys confirmed that difference between the two groups (Tuesday and Wednesday) in this population are minimal:

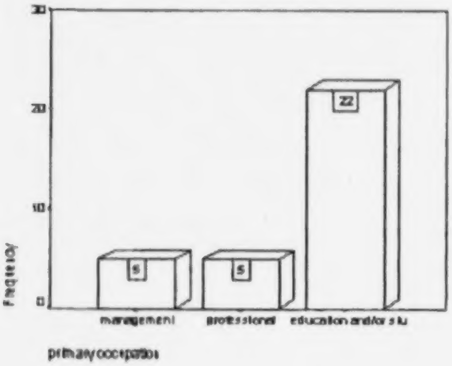
> 65.5% of the Tuesday participants are Asians/Pacific Islanders, 64.5% of the students in the Wednesday group report belonging to the same ethnicity group. 18.8% (T) vs. 26.9% (W) are Caucasians/White; 75% (T) vs. 81.5% (W) have a college degree, 21.9% (T) vs. 14.8% (W) have a masters degree; 15.6% (T) vs. 14.8% (W) work in a management field, 68.8% (T) vs. 70.4% (W) are in the education field (mostly as students); - see Figure 2 - Additionally: 96.9% (T) vs. 92.6% (W) are between 20 and 29 years old - See Figure 3 -

FIGURE 2
PRIOR WORK EXPERIENCE

Wednesday Group Demographics

WORK1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	management	5	15.6	15.6	15.6
	professional	5	15.6	15.6	31.3
	education and/or student	22	68.8	68.8	100.0
	Total	32	100.0	100.0	
Total		32	100.0		



Tuesday Group Demographics

WORK1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	management	4	14.8	14.8	14.8
	professional	4	14.8	14.8	29.6
	education and/or student	19	70.4	70.4	100.0
	Total	27	100.0	100.0	
Total		27	100.0		

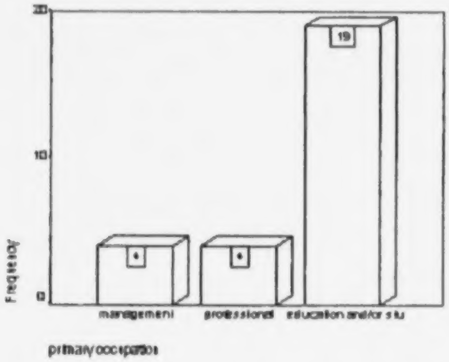


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FIGURE 3
AGE OF THE LEARNERS

Wednesday Group Demographics

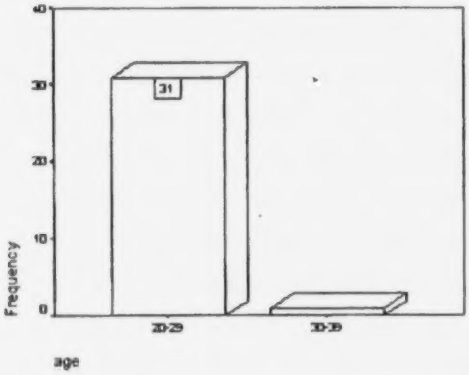
AGE

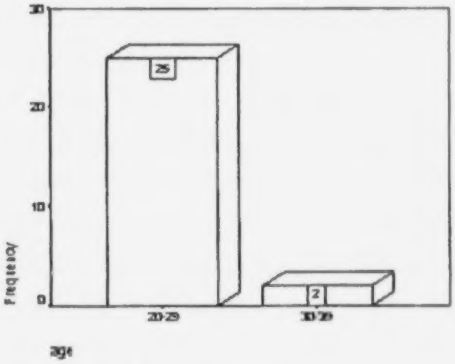
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	31	96.9	96.9	96.9
	30-39	1	3.1	3.1	100.0
	Total	32	100.0	100.0	
Total		32	100.0		

Tuesday Group Demographics

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	25	92.6	92.6	92.6
	30-39	2	7.4	7.4	100.0
	Total	27	100.0	100.0	
Total		27	100.0		





43.8% (T) vs. 55.6% (W) report of having been using a computer for 7 years or more;
50% (T) vs. 59.3% (W) are male;
37.5% (T) vs. 40.7% (W) report of having used the computer primarily at work/school, but also at home.

The frequencies values reported above display ranges of differences from 0.9% to less than 10% difference on same measures, with the mode of occurrences concentrating on the lower differences. Because more recent assignments of students to cohort groups have standardized stratification mechanisms, it is expected that similarities in the groups are further increased in the groups participating in the redesigned study.

Satisfaction & Attitudes – Pilot Study (3)

A pilot test of the undergraduate students (senior level) was undertaken in one section of a 'Change in Organizations' course. The main objective of the pilot was to collect feedback on undergraduate students' appreciation of the selected project management topic, and their attitudes toward the experimental procedures (i.e. special attention focuses on their reactions to the presentations, and their interest in attending another session on the topic). Because the sample size of the pilot group was small (44 students present in the sessions), and their subgroups were composed of only 15 or less students, the results from the statistical analysis are not reliable, and are omitted in this discussion. Interesting findings, however, emerge from the descriptive frequencies analysis of satisfaction, and appeal measures (see Figure 5 and Figure 6).

Figure 4 shows that students in the lecture group (#1) were the most satisfied with the organization, pace, content of instruction, and with the instructor's presentation (means > than 4.5). The other groups' satisfaction was also above the mid-point (mean = 4), with the CD-ROM group being more satisfied than the textbook group with the organization of the materials (ORGANIZ). At the same time, the CD-ROM group was the least satisfied in terms of content, pace, and presentation (FRAME). Although the size of each difference was within a 1-point difference, the CD-ROM participants were consistently least satisfied with the materials, and felt that they did not learn the material satisfactorily (LEARN).

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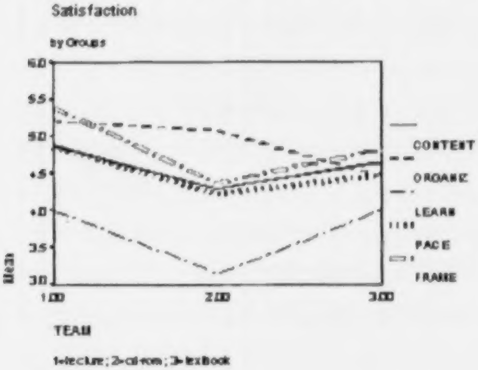
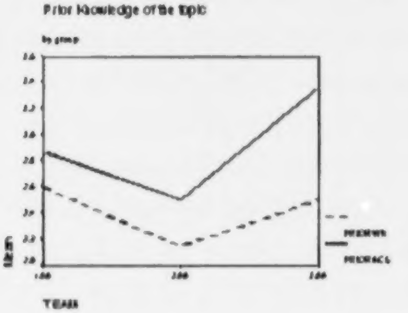
FIGURE 4
SATISFACTION SURVEY DATA, UNDERGRADUATE PILOT STUDY, FALL 1999



It is interesting to compare the values in *Figure4* with other results. Students in the CD-ROM group (#2) reported that they had the least prior knowledge of the topic (Figure 5a), but they obtained the highest pretest and posttest mean scores (Figure 5b), with the limitations that the sample size is not sufficient to use formal parametric procedures, as well as draw conclusions from comparative differences.

FIGURE 5
PRIOR KNOWLEDGE OF THE TOPIC

Figure 5a: Self-reported Prior Knowledge



Additionally, 30% of the students answered that they would like to attend another instructional session similar to the one in which they participated; and 41% answered that they 'may' prefer attending a similar session (Figure 6).

Figure 5b: Pre-TEST—Posttest Differences

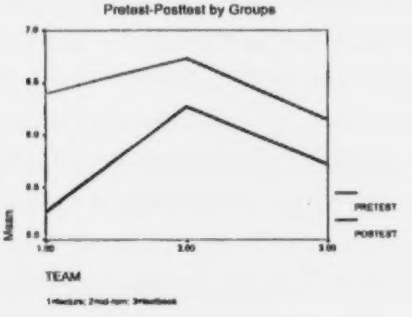
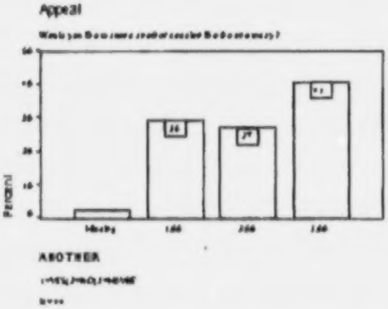


FIGURE 6
APPEAL RESPONSE, UNDERGRADUATE PILOT STUDY, FALL 1999



The appeal measure is encouraging, especially if contrasted with the conditions of the pilot study. Students in this pilot were substantially rushed into the instructional materials because of the logistic arrangements, the lack of proximity of the laboratory and the reading facilities, the need to perform other miscellaneous administrative tasks, substantially reducing instructional time. The CD-ROM group did not complete all the assigned sessions, and spent only a total of 17-minutes using the application. Similar time-constraints characterized the textbook-group; whereas the in-class group is the only group that used the time satisfactorily.

The conclusions of this pilot (#3) led to an improvement in scheduling efforts, with each group meeting directly in the classroom in which the treatment is offered, and reassured the researcher of the appropriateness of using the 'change control' topic with this group of students.

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Lesson learned from this, and the other pilots, guided the implementation of better-enforced laboratory procedures.

CONCLUSIONS FROM THE PILOT STUDIES

The implementation of the pilot studies has been critical to the design of an improved methodology. First of all, it has demonstrated that the ambition to conduct such experiments outside controlled lab environments is tainted with the inability to control the learning process. It results in high-mortality due to conflicting tasks and, above all, lack of reliability of self-reported indication on how/for-how-long the CD-ROM was used. The evaluation of the comparative effectiveness can be conducted only if both the instructional material and the instructional conditions are equivalent (controlled laboratory setting). This calls for the application of these types of experiments only for a limited amount of time, unless the researcher has full control on the many intervening variables (study and practice time, etc.). It is no surprise that similar experiments have led to conclude that there are "no differences in learning across instructional materials . They did not take into account the study-time/efforts of the learners, which obviously influences success in the final exam regardless of the tool used to study the instructional material.

Secondly, the pilot studies have helped assess the comparability of the groups being tested and refined the survey instruments. Thirdly, they have helped screen out learners' attitude (both graduate and undergraduate students) towards the study material, which is also another important component of students' learning.

VALUE OF THE STUDY

Once if is completed and implemented with the changes suggested by the pilot studies herein described, this study will contribute to research on instructional technology effectiveness in several ways.

It will offer a unique comparative situation, with coincident topic presentation across media (multimedia, textbook, in-class instruction). Therefore, it will enable the researcher to control for content-differences biases found in earlier studies. The research design overcomes several limitations of these earlier studies (controlling for time, instructor, and content-differences), and presents a framework that addresses previous concerns. This research will contribute to the advancement of the debate on effectiveness of instructional technologies by looking at one specific medium, and its comparative impact. In fact, it responds to calls for further research in areas that have key instructional implications for education and training.

By replicating this research with undergraduate and graduate students, with higher and lower complexity topics, and contrasting direction and magnitude (effect size), this research offers further validation procedures. The replication also differentiates learning and satisfaction by groups (undergraduate and graduate), and topic complexity. Statistically significant differences among the age groups, for example, allow the measurement of media effectiveness on different learner populations. Learning goals may not be achieved because the learner's developmental stage (Piaget & Inhelder, 1969) has not reached the level of sophistication that benefits from the medium instructional approach. Or, they may not be achieved because the complexity of the topic requires different instructional representations to foster understanding first, then, retention and application. This study helps investigate these relationships by including these dimensions in the research design.

BIBLIOGRAPHY

Clark, R. E. (1983). "Reconsidering Research On Learning From Media. *Review of Educational Research*, 53(4), 445-459.

Clark, R. E., & Sugrue, B. M. (1995). "Research on Instructional Media, 1978-1988. G. J. Anglin (Ed.), *Instructional Technology: Past, Present, Future* (2nd ed., pp. 348-364). Englewood, Colorado: Libraries Unlimited, Inc.

Cunningham, D. J., Duffy, T. M., & Knuth, R. A. (1993). "The Textbook of The Future. In C. McKnight, A. Dillon, & J. Richardson (Eds.), *Hypertext: A Psychological Perspective* (pp. 19-50). Chichester, England: Ellis Horwood.

Duffy, T. M., & Knuth, R. A. (1990). "Hypermedia And Instruction. Where Is The Match? In D. H. Jonassen, & H. Mandl (Eds.), *Designing Hypermedia For Learning* (Vol. 67pp. 199-225). Berlin: Springer-Verlag.

Engelkamp, J., & Zimmer, H. D. (1994). *The Human Memory: A Multimodal Approach*. Seattle/Toronto: Hogrefe & Huber Publishers.

Fletcher-Flinn, C. M., & Gravatt, B. (1995). "The Efficacy Of Computer Assisted Instruction (CAI): A Meta-analysis. *Journal of Educational Computing Research*, 12, 219-242.

Gardner, H. (1984). *Frames of Mind*. New York: Basic Books.

Gardner, H. (1993). *Multiple Intelligences: The Theory in Practice*. New York: Basic Books.

Goleman, D. (1995). *Emotional Intelligence: Why It Can Matter More Than IQ*. New York: Bantam Books.

Hammond, N. (1993). "Learning with Hypertext: Problems, Principles, and Prospects. In C. McKnight, A. Dillon, & J. Richardson (Eds.), *Hypertext: A Psychological Perspective* (pp. 51-69). Chichester, England: Ellis Horwood.

Jacobson, M. J., & Spiro, R. J. (1995). "Hypertext Learning Environments, Cognitive Flexibility, and the Transfer of Complex Knowledge: An Empirical Investigation. *Journal of Educational Computing Research*, 12(4), 301-333.

Jonassen, D. H. (1990). "Semantic Network Elicitation: Tools for Structuring Hypertext. In C. Green, & R. McAleese (Eds.), *Hypertext: State of the art*. Oxford: Intellect Books Ltd.

Jones, T. H., & Paolucci, R. (1998). "The Learning Effectiveness of Educational Technology: A Call for Further Research. *Educational Technology Review*, Spring/Summer(9), 10-14.

Keller, J. M. (1983). "Motivational Design of Instruction. Reigeluth (Ed.), *Instructional Design Theories and Models: An Overview of Their Current Status* (pp. 383-434). NJ: Hillsdale.

Kemp, J. E., Morrison, G. R., & Ross, S. M. (1994). *Designing Effective Instruction*. Englewood Cliffs, NJ: Merrill/Prentice Hall.

Khalili, A., & Shashaani, L. (1994). "The Effectiveness of Computer Applications: A Meta-analysis. *Journal of Research on Computing in Education*, 27(1), 48-61.

Kulik, C. C., Kulik, J. A., & Shwalb, B. J. (1986). "The Effectiveness of Computer-based Adult Education: A Meta-analysis. *Journal of Educational Computing Research*, 2(2), 235-252.

Kulik, J. A. (1994). "Meta-Analytic Studies of Findings on Computer-Based Instruction. E. L. Baker, & H. F. O'Neil (Eds.), *Technology Assessment in Education and Training* (pp. 9-33). Hillsdale, NJ: Laurence Erlbaum Associates.

Liao, Y. C. (1998). "Effects of Hypermedia Versus Traditional Instruction on Students' Achievement: A Meta-analysis. *Journal of Research on Computing in Education*, 30(4), 341-359.

Marks-Tarlow, T. (1995). *Creativity Inside Out: Learning Through Multiple Intelligences*. Reading, MA: Addison-Wesley.

Mayer, R. E. & Anderson R. B. "Animations Need Narrations: An Experimental Test of a Dual-Coding Hypothesis. *Journal of Educational Psychology* 83 (1991): 484-90.

McLellan, H. (1996). "'Being Digital': Implications for Education. *Educational Technology*, Nov-Dec, 5-20.

Merrill, M. D. (1983). "Component Display Theory. C. M. Reigeluth (Ed.), *Instructional-design Theories and Models: An Overview of Their Current Status* (pp. 282-333). Englewood Cliffs, NJ: Erlbaum.

Nugent, G. (1982). "Pictures, Audio, and Print: Symbolic Representation and Effect on Learning. *Educational Communication and Technology Journal*, 30, 163-174.

Paivio, A. (1986). *Mental Representations. A Dual-coding Approach*. New York: Oxford University Press.

Piaget, J., & Inhelder, B. (1969). *The Psychology of the Child*. New York: Basic Books.

Roblyer, M., Edwards, J., & Havriluk, M. A. (1997). "Planning and Implementation for Effective Technology Integration. *Integrating Educational Technology into Teaching* (pp. 27-53). Upper Saddle River, NJ: Merrill, Prentice Hall.

Roblyer, M. D., Castine, W. H., & King, F. J. (1988). "Assessing the Impact of Computer-based Instruction. *Computers in the Schools*, 5(3-4).

Tergan, S.-O. (1997). "Multiple Views, Contexts, and Symbol Systems in Learning with Hypertext/ Hypermedia: A Critical Review of Research. *Educational Technology*, July-August, 5-18.

Tulving, E. (1983). *Elements of Episodic Memory*. London: Oxford University Press.

A SURVEY OF ELECTRONIC BUSINESS AND ELECTRONIC COMMERCE DEGREE PROGRAMS

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ABSTRACT

The amount of business conducted electronically is, by some estimates, expected to grow to well over one trillion dollars by 2003. Along with the rapid growth comes a continual and constant redefining of terms, directions, and goals — both for the business world and for academia. While Electronic Business (EB) and Electronic Commerce (EC) courses are being offered at many colleges and universities, fewer schools sponsor entire degree programs in the area. As more businesses step into the electronic arena, the demand for "E-Smart" business managers will increase, along with the need for more focused degree programs. How have universities already responded to this ever-growing need? What new research programs and centers are being considered to handle the demand? In this paper, existing degree programs, concentrations, and research centers within the United States are examined. The research project presented herein is continuing and more EC program information will be presented at the IAIM conference in December 2000.

INTRODUCTION

While estimates of the amount of business conducted electronically vary, few would disagree that electronic business (EB) and electronic commerce (EC) have had and will continue to have a major impact on the global economy. As the impact grows, more managers will find it necessary to enhance their knowledge of electronic business (Khirallah 2000). Thus, it is not surprising that EB/EC courses are now being offered at colleges and universities throughout the world. The number of courses has risen significantly during the last few years, with five times more courses being offered in 1999 than in 1997 (Sendall, 1999).

While only a few years ago the single EC course was a rarity, now entire degree programs are being offered. Some universities generally the larger research institutions have started EC Research or Resource Centers. Furthermore, these research centers and degree programs are expanding rapidly. In 1995, Vanderbilt University started the first EC concentration with one student. The program now boasts "a dozen professors, nineteen courses and a center devoted to E-research (Lord 2000, p.62)." This year, U.S. News and World Report published a separate ranking for E-Commerce programs within its rankings of business school departments (September, 2000).

Organizations, feeling the pressures to remain competitive in the EB world, are in turn pressuring colleges and universities to develop programs in far less than the traditional time allotted to such curricular activities. Centers for EB research are appearing throughout academe, and more courses and degree programs are being implemented every semester. In this paper, the Research Centers and degree programs at more than one hundred universities throughout the world are examined to answer the following research questions:

1. What universities have Electronic Commerce Research Centers/Institutes?
        Center name

School/college/department responsible for center
Stated purpose of center

2. What degree programs are being offered?
   Graduate (MBA/MS) and undergraduate
   Program focus (technical/managerial/marketing/etc.)
   Tracks/concentrations/courses offered within the degree

This research is ongoing. Internet searches for new EC centers, degree programs, and courses are performed monthly and new information is then added to the collection. Thus, the data presented in this paper will be updated at the IAIM conference in December 2000.

METHODOLOGY

The research project began with an Internet search for Electronic Commerce centers, degree programs, and course offerings at AACSB-accredited schools. The web site for each school was explored to discover to what extent the school had entered the EC arena. This research was naturally limited due to the nature of the World Wide Web: schools that do not index or provide relevant information on their web sites would not be included in the results. In some cases, schools were contacted to obtain further information. Some Internet searches yielded web sites that posted lists of Electronic Commerce programs. These web sites are listed in the references.

During the course of the Internet searches, several email requests for information about EC programs were sent to the ISWorld listserv by MIS faculty in other institutions (Gupta 2000; Press 2000). The results of those requests were compiled and published on the list. These compilations were then used in this research and information about the programs added to the results herein. One request yielded an additional web site that included more information about EC programs (Warkentin, 2000). More recently, a search for international EC programs has been conducted. The results of that search is not included herein, but will be presented at the conference.

RESEARCH FINDINGS

The various Internet searches and listserv requests yielded information regarding a number of Electronic Commerce Research Centers, extensive graduate and undergraduate degree programs, certificate programs, and courses offered at the universities. In this section, a summary of the findings is presented.

Electronic Commerce Research Centers

There are a number of Electronic Commerce Research Centers located in university settings. While some of these centers are well established (e.g. Vanderbilt's eLab was founded as Project 2000 in 1994), new centers are being created each year. Thus, compiling this list was truly an attempt to shoot at a fast moving target. In some cases, web sites did not explicitly indicate a research center, so it is probable that many more centers exist.

For each center found, the name, web address, stated purpose and some details are presented in Table 1. Interestingly, only two centers clearly state that they are inter-disciplinary (UT Austin and Carnegie Mellon), although most of the centers involve more than one area within the business school. These centers are all linked to degree or certificate programs through the university; these programs are presented later in the paper.

Electronic Commerce Degree Programs

In the last few years, the number of degree programs in Electronic Commerce has skyrocketed. Schools now offer (at the undergraduate level) degrees in EC, EC concentrations within a general business, Management, MIS or marketing degree, and certificate programs in EC. At the graduate level, many schools offer an MBA concentration in EC as well as an MS in EC. Some schools also offer a graduate certificate in EC. In this section, more detail regarding these degree programs is provided.

Of the 122 universities examined in this research project, only four offer an undergraduate degree in Electronic Commerce. These schools are: University of Toledo, University of Scranton, Texas Christian University, and University of South Alabama. Three schools offer a concentration in EC within another major area. The major areas are Information Systems, General Business, and Marketing. No schools were found that offered an undergraduate certificate program, but two schools offer an EC minor. This information is summarized in Table 2.

At the graduate level, there are many more degree programs. Fifteen schools offer an MS in Electronic Commerce. Six schools were found to offer an MS in other areas with an EC concentration. Two schools offering the EC concentration have degree programs in Management; the degree program at the other four schools is in IS. The most popular degree program is the Electronic Commerce concentration within the MBA degree. Twenty-nine schools were found that offer this option. As might be expected, the MBA programs appear to focus on either the technical or the managerial aspects of EC; however, it was not always possible to discern this from the web sites. This information is summarized in Tables 3, 4 and 5.

Only four schools were found to offer graduate certificates in EC, and these programs were quite diverse. At Georgia Institute of technology, for example, students can concentrate in one of four areas: electronic management, networking, interface design or multimedia. At Southern Methodist University, there are three distinct tracks offered: The EC Professional track, the Application Developer track, and the Security Specialist track.

TABLE 1
UNIVERSITY ELECTRONIC COMMERCE RESEARCH CENTERS (U.S. SCHOOLS)

University	Location	Name	Web Address	Purpose (as stated on the web site)
Brigham Young University	Business	Rollins Center for eBusiness@BYU	http://marriottschool.byu.edu/ebusiness/about/index.htm	...fosters mutually beneficial relationships among faculty, students, and industry. In addition, the Center supports multidisciplinary research pertaining to innovative Information systems strategies, eBusiness, high-tech research, information technology application, and consulting.
Carnegie Mellon University	Business, Public Policy and Computer Science	Institute for E-Commerce	http://www.ecom.cmu.edu/	...to serve as a focal point for Electronic Commerce activities at Carnegie Mellon University, located in Pittsburgh, PA, to offer degree programs and executive education and to conduct research.
Creighton University	Business	Joe Ricketts Center in Electronic Commerce and Database Marketing	http://ecommerce.creighton.edu/	... to be a focal point for e-commerce education and a resource base for the business community in e-commerce and database marketing. The center partners with local and national businesses to share knowledge about e-commerce with educators, students and other businesses. The center will sponsor electronic business education programs and research as well as organize conferences on e-commerce and database marketing.
Emory University	Business	Center for Electronic	http://www.cc.emory.edu/BUSINESS/	...a means of coordinating research and practice

		Commerce	welcome.html	in the important areas associated with future forms of commerce. The center is organized to conduct research, facilitate informative and collaborative meetings, deliver reports and presentations, facilitate industry trade group initiatives, and promote industry revitalization and preparation for 21st century business practice.
Georgia Institute of Technology	Business	iXL Center of Electronic Commerce	http://www.mgt.gatech.edu/centers/centers_ixl.shtml	...to sponsor state-of-the-art research and education in the emerging field of electronic commerce. The Center provides recommendations on how best to solve e-commerce challenges and problems, using real-world businesses as subjects for research projects and giving graduate students hands-on experience. The research and teaching activities of the Center focus on six key areas: online marketing, strategic uses of business-to-business inter-organizational systems, information security, information technology-enabled entrepreneurship, business intelligence, and business models for Internet-based ventures.
Georgia State University	Business	eCommerce Institute	http://www.eci.gsu.edu/	To discover, assimilate, facilitate and disseminate knowledge regarding all facets of e-commerce (business-to-business, business-to-consumer) through programs of education, research, incubation and outreach; in so doing, to position the Institute and its faculty, staff, students and partners as trusted sources of competence and knowledge in this area, to better promote and effect change in organizations and the markets they serve.

University	Location	Name	Web Address	Purpose (as stated on the web site)
	Business	The Center for Digital Commerce (research center within the eCommerce Institute)	http://www.eci.gsu.edu/research.htm	to promote cross-disciplinary collaboration among the many areas impacted by e-commerce. The Center seeks to be a major resource for Georgia in attracting and retaining "industries of the mind."
La Salle University		Electronic Commerce Institute	http://alpha.lasalle.edu/academ/ecommerce	...promote the field of e-commerce. The Institute will utilize faculty and business professional expertise so e-commerce learning may be applied to the entire student population. The Institute will apply real world applications to develop an e-commerce knowledge base.
MIT	Business	Center for eBusiness@MIT	http://ebusiness.mit.edu/	...to provide leadership for faculty, students, and industry interested in Internet-enabled business. Our mission is to be the leading academic source of innovation in management theory and practice for eBusiness.
Stanford University	Business	Center for Electronic Business and Commerce (CEBC)	http://www.gsb.stanford.edu/cebc/	... the development of new research and courses to understand the impact of information and communication technologies on firms, industries and markets. ... to leverage existing knowledge creation and curriculum development efforts and start new ones.
Temple University	Business	Irwin L. Gross eBusiness Institute	http://www.sbm.temple.edu/ebi/	Laboratory. Classroom. Forum for dialogue. Think tank. Project applications group. Business incubator. Virtual library and resource center eBI leverages The Fox School's research expertise, educational resources, global presence and entrepreneurial spirit to prepare business leaders and help them develop strategies and models for the digital economy

University	Location	Name	Web Address	Purpose (as stated on the web site)
University of Texas Austin	Business, Computer Science, Law, Economics, Communication and Library Science	Center for Research in Electronic Commerce	http://crec.bus.utexas.edu/	...seek to provide an efficient and effective framework for global electronic commerce and the digital economy through an integrated research agenda that focuses on correlative effects among network infrastructure, products, processes, payment systems and policies, using markets and economic analysis as the central unifying theme. The Center's vision is to assure that electronic commerce processes and applications achieve their efficient outcomes promised for the digital age.
Vanderbilt University	Business	eLab Electronic Commerce Research Laboratory	http://ecommerce.vanderbilt.edu/	...a corporate sponsored research effort devoted to the scholarly and rigorous investigation of the marketing implications of commercializing hypermedia computer-mediated environments (CMEs) like the World Wide Web and other emerging electronic environments. Elab research objectives are to enrich and stimulate the knowledge base on the role of marketing in new media environments, provide a principal point for the discussion and exchange of these ideas, and impact business practice in this emerging area.

TABLE 2
UNDERGRADUATE PROGRAMS IN ELECTRONIC COMMERCE

Program	School	Degree
Undergraduate Major	Texas Christian University	BBA in Electronic Business
	University of Scranton	
	University of South Alabama	
	University of Toledo	BBA in Electronic Commerce
EC Concentration	Old Dominion University	BSBA Information Systems
		BSBA Marketing
	Rutgers	BS Management
	Utah State University	BS in BIS
Undergraduate Minor	University of Toledo	
	University of West Florida	

TABLE 3
GRADUATE PROGRAMS IN ELECTRONIC COMMERCE: MS DEGREE

University	Degree Name	Example Courses Offered
Arizona State	MSIM in Electronic Commerce	Technical Foundations of EC Business Database Concepts Distributed IS
Barry	MS in Electronic Commerce	Not available
Carnegie Mellon	MS in Electronic Commerce	EC Management EC Technology Core java in EC
Capitol College	MS in Electronic Commerce Management	Managing the Global Virtual Organization with Technology Leadership, Motivation and Obtaining Results at a Distance Business Technologies
Claremont Graduate School	MS in Electronic Commerce	Database Concepts Electronic markets Electronic Economics
Creighton	MS in Electronic Commerce	Introduction to EC Development Technology for the Web Special Topics in EC
DePaul	MS in Electronic Commerce	Usability Issues Advanced WEB IS Extranet Systems
Golden Gate	MS in Electronic Commerce	Electronic Commerce Industry and Technology Electronic Commerce Systems and Technologies Professional Practice Project in Electronic Commerce
Illinois Institute of Technology	MS in Electronic Commerce	E-commerce Organization Design Customer Relationship Management E-Commerce Security & Payment Systems
National University	MS in Electronic Commerce	Principles of Electronic Commerce Embarking on Electronic Commerce Global Network Marketing and Advertising
Northwestern	MS in Electronic Commerce	Fundamentals of Technology and E-Commerce Intellectual Property Strategies for Managers of E-Commerce Internet Business Models and Technology
Notre Dame California	MS in Electronic Business Management	Foundations of the Digital Economy Fundamentals of Internet Architecture Marketing & the Internet
Rice	MBS in Electronic Commerce	Strategic Services Management Internet Infrastructure Electronic Commerce
San Francisco State	MSBA in Electronic Commerce	Seminar in ED Site Design and Management Seminar in Distributed Data Processing Internet Marketing
Temple	MS in Electronic Commerce	Information Architecture and networking IS Management & Process Database Analysis and Design
University of San Diego	MS in Electronic Commerce	Introduction to EC Web Site Design and Management Ethics and Law for Online Organizations
Wisconsin - Milwaukee	MS in Electronic Business	Introduction to Electronic Business Development of EB applications Analysis and Design of E-systems

TABLE 4
GRADUATE PROGRAMS IN ELECTRONIC COMMERCE: MS WITH EC CONCENTRATION

School	Degree Area	Example Courses
Denver	Information Technology	Systems Analysis & Design Introduction to EC DBM Systems
Georgia State University	Information Systems	Electronic Marketing Economics of Digital Business EC Infrastructure
Loyola University - Chicago	Information Management	Website Planning & Development Internet Marketing Electronic Commerce
New Jersey Institute of Technology	Management	Internet for Managers Internet Marketing Strategy
North Carolina State	Management	Managing the Digital Enterprise EC Technology Networking for EC
Purdue	Management	EC & Supply Chain Management E People Competition in EC
Rochester Institute of Technology	Information Technology	IT & Organizational Process Inter-Enterprise Computing IT & Strategic Opportunity

TABLE 5
GRADUATE PROGRAMS IN ELECTRONIC COMMERCE: MBA WITH EC CONCENTRATION

Schools

Arizona State
Brigham Young
Denver
Drexel
Emory
Florida Atlantic
Georgia State University
Illinois Institute of Technology
Loyola - Chicago
Maryland
MIT
National University
New Jersey Institute of Technology
Notre Dame
Old Dominion
San Francisco State
Santa Clara State
Southern Illinois - Edwardsville
Temple
University of North Carolina - Chapel Hill
University of Pennsylvania
University of Rochester
University of Texas - Austin
University of Washington
Vanderbilt
Virginia Tech
Wake Forest

In some cases, the web site did not offer enough information to determine the exact degree offering. Northwestern University graduate school, for example, offers a Technology and E-Commerce "program" within which some nineteen courses (across the technology, marketing, management and operations areas) are offered, but there are no specifics regarding the degree issued upon completion.

EC Course Offerings

A large number of schools that do not offer full degree programs in EC now offer Electronic Commerce courses. While the majority of schools (48) still offer only one EC course, that is beginning to change. Thirteen schools offer two courses in EC, and three schools offer three courses. One school offers four courses in EC. Of the schools offering only one course, thirty-five of them offered the course in the IS area. Other areas represented included: Marketing (2), Management (3), Accounting (1), and General Business (5). Two schools listed their courses with an MBA designation only. Twenty-two of the schools offered the course at the graduate level, while twenty-one schools had undergraduate courses. Five schools did not specify the level of the course.

For schools offering two courses, there was more diversity among the areas represented. Three schools split the courses between IS and Marketing, two schools offered both courses under Management, one school offered the courses in Accounting and Business, and five schools offered both courses in IS. Four of the schools offered only graduate classes; four offered both classes at the undergraduate level and four were split, offering one course at each level.

Only three schools offered three courses without specifying a concentration or degree program. For these schools, the course offerings were at the graduate level and were offered by the IS department. The school that offered four courses without specifying a concentration or degree program in EC offered them all at the graduate level with an MBA designation. From the titles of the courses, however, it is apparent that they spanned several business disciplines (Technology, Strategy and Marketing).

SUMMARY

As Electronic Commerce interests in the business world continue to grow, it is reasonable to expect that universities will seek to expand their programs and course offerings. As these universities look to develop electronic business or electronic commerce concentrations or degree programs, they can learn from programs that already exist. This is evidenced by the requests to the ISWorld listserv for course and program information regarding E-commerce.

In many respects, compiling a list of E-commerce programs is a daunting task, as the number of programs seems to grow rapidly. New research centers and initiatives, new course offerings and degree programs and new certificate programs become available every month. Given this rapid program development, we may be approaching a time when universities need to consider if offering an EC program is a viable option or overkill. In light of the critical shortage of IS faculty at many institutions, is it wise to begin a new program that further taxes the staff?

It is hoped that this paper provides some insight to those faculty and institutions seeking to develop EB/EC programs and for those professors teaching such courses at either the undergraduate or graduate level. Furthermore, those responsible for IT curriculum and schools involved in AACSB accreditation or re-accreditation efforts may also find the research helpful.

REFERENCES

Khirallah, D.R. (2000), "The ABCs of E-business". Informationweek. March 20, pp 46-60.

Lord, M. (2000). "Suddenly, E-Commerce is the Hot New Specialty". U.S. News & World Report, April 10, pp 62-63.

Sendall, P. (1999), "A Survey of Electronic Commerce Courses", Proceedings of the 14th Annual Conference of the Academy for Information Management, Charlotte, NC, p 119-128.

U.S. News & World Report (2000), "2001 College Rankings , http://www.usnews.com/usnews/edu/college/corank.htm, September, 2000.

WEB SITES

http://som.csudh.edu/fac/lpress/temp/ecommercedocs/university.htm (from Larry Press' request to ISWorld, April 2000.

http://www.cba.neu.edu/~mwarkentin/ecomm/univprgm.htm, Merrill Warkentin

http://bsuvc.bsu.edu/~00jngupta/ebiz.txt(from J Gupta's request to ISWorld, June 2000)

http://www.dmoz.org/Business/E-Commerce/Education/Courses/ (listing of E-Commerce courses)

EXPERIENTIAL LEARNING IN THE INTRODUCTORY MIS CLASS: INTERVIEWS WITH IT PROFESSIONALS

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ABSTRACT

Students enter the introductory MIS class having heard all the hype regarding the IT profession, but often knowing little of the realities. In an effort to have general business students gain a deeper understanding of the IT profession and the IT professional, the authors developed an interview exercise that serves many purposes. Students receive instruction on conducting interviews and the research project in which they are participating is described. Then each student selects an appropriate interview candidate and researches the candidate's organization. Each student conducts an in-depth interview, including both a structured and an unstructured interview. Each student submits a paper describing the organization and reporting on interview results. Finally, each student makes a formal presentation to the class. This article details the methodology for this pedagogical exercise and reports results obtained after over one hundred interviews. Benefits achieved are substantial from a pedagogical, research, and community-relations perspective.

INTRODUCTION

The introductory Management Information Systems (MIS) class at the undergraduate level in most universities represents the only opportunity most business students have to learn about the Information Systems (IS) or Information Technology (IT) profession. The topics covered in this course vary greatly among schools. (See O'Hara and Stephens, 1999a and 1999b and Stephens and O'Hara, 1998 for more details regarding course topics and requirements). While there is typically some exposure to the real world, it is usually limited to exploring case studies, performing web-based research, or listening to guest speakers in class.

One way to allow students to explore the profession is for them to conduct field interviews with IS professionals. This interview activity serves a number of useful purposes. First, it provides the student with a unique opportunity to develop their research skills by conducting a formal interview with the professional. It also allows students to interact with someone in the IS/IT field. This is very often the first formal interaction students have with these professionals. This experiential learning exercise has proved very valuable to the students. Second, since the interview is preceded by hands-on training in conducting an interview, students gain valuable skills they can use throughout their business careers. Before conducting the interview, students must explore the company they plan to visit -- either doing web-based (preferred) or library-based research. Students then write a synopsis of the company. After conducting the interview, students present their findings to the class, share the insights they gained from the process, and submit all written documentation to the instructor.

In this paper, the authors first provide some background on experiential learning in the IS class. They then offer details concerning the interview assignment, and how the assignment helps students hone a variety of skills. While the purpose of this paper is not to explore the results of the interviews, the major insights and lessons learned by students are also shared.

EXPERIENTIAL LEARNING IN THE IS CLASS

Experiential learning may be simply defined as active participation in the learning process. In general, experiential learning (or education) involves "immersing students in an activity (ideally closely related to course material) and then asking for their reflection on the experience" (Clements, 1995, p. 116). The value of experiential learning has been known for some time. As early as 1916, Dewey stated:

> In schools, those under instruction are too customarily looked upon as acquiring knowledge as theoretical spectators... the very word pupil has almost come to mean one who is engaged not in having fruitful experiences but in absorbing knowledge directly (Dewey, 1916, p.164).

Carl Rogers, the noted psychologist, defined two types of learning: meaningless and significant. Meaningless learning involved memorization and cognitive process; significant learning was directed to the specific needs and wants of the learner. For Rogers, experience was paramount:

> The touchstone of validity is my own experience. No other person's ideas, and none of my own ideas, are as authoritative as my experience (Rogers, 1995, p.63).

To Rogers, the teacher's role was to facilitate significant learning through experience.

Experiential learning currently plays a significant role in higher education. Programs exist in Arts and Humanities, the Social Sciences, and the Professional and Technical fields (Cantor, 1997). These programs take many forms, including role-playing, community-based work programs, and internships. Still, experiential learning does not need to be so formalized. It can occur more simply when faculty provide the means for students to gain more relevance from their educational experiences, something students are demanding (Matson and Matson, 1995).

Experiential learning has been popular in MIS classes as well. MIS faculty have long recognized the need for and value of student exposure to the workplace (Dick and Jones, 1995), and often include a real-world component. In the Systems Analysis and Design class, for example, students often interview each other to learn various information gathering techniques and design systems for small businesses in the community. Another class in which a real-world project is often undertaken is the Database class. Inclusion of a real-world project in the introductory class is much less common. Students in this class cannot typically develop an information system, nor is there is knowledge extensive enough to complete an internship. For these students, an alternative to a full-scale project is an interview with an IS professional.

THE INTERVIEW ASSIGNMENT

The specifics of the interview assignment have changed since it was first used in the MIS class. Initially, students simply found a likely candidate, conducted an unstructured interview and reported their results to the instructor in writing. During the last two years, the assignment has evolved into a multi-faceted, multi-purpose project. Results of the interviews conducted by students are being studied by the faculty involved and will be reported on in another venue.

The first aspect of the project is developing interview skills. Some students, especially the traditional ones, have never taken part in an interview—on either side of the desk. Most who have participated in interviews have been the interviewees, not the interviewer, so this is a new role for them. Thus, at least one full class (75 minutes) is devoted to developing interview skills. Topics such as courtesy, staying focused on the interview questions, providing verbal and non-verbal feedback, and closing the interview are discussed. The final exercise of the interview skills class is a hands-on one. Students practice the first few moments of the interview—often the most awkward—with the instructor. They "enter" the interviewee's office, shake hands, make small talk and get started on the interview.

Next, the interview form itself is distributed to the students electronically. The form consists of two parts: The Structured and Unstructured Questions. The Structured Interview section has three sub-sections: The IT Profession, Job Satisfaction, and Work Environment

(See Appendix A). These questions were developed and pre-tested over two semesters. Students are told to begin thinking about what questions they might want to ask during their interview, and to continue to formulate questions as they determine their interviewee and conduct their company research. As interviews are conducted and presented to the class, students gather ideas for the unstructured questions they will ask.

Students then find an IS person to interview. Oddly, this has never proved problematic for them— there always seems to be enough IS people available and willing to participate. Students are free to interview people who work in any IS capacity— from help desk to CIO. This allows for a broader base of information to be shared with the class. Interviews may be taped; this is mutually determined by the student and interviewee. Students are encouraged to keep the interview time under one hour to accommodate busy IS professionals.

Students must follow strict guidelines when setting up the interview. They must get the interviewee's permission to be identified to the instructor (identities can be kept from the students in the class). Participants must also agree to take part in a possible follow-up study from the university. Students must call to confirm the interview two working days before it is scheduled. When the interview is completed, students must send the IS professional a copy of the interview for review, and obtain a signed statement from the participant that the information is factual and accurately presented. Finally, students must follow-up the interview with a Thank You note, a copy of which must be submitted to the instructor.

Once the interviewee is selected, the student submits the person's name, title and job description to the instructor for approval. Only rarely are interviewees deemed unacceptable. Reasons for such have included duplicate interviews (i.e., the previous semester) and an overabundance of interviewees in the same areas (e.g., programmers). Discussions of the interviews are scheduled to coincide as much as possible with course topics. Thus, interviews with network engineers and administrators are presented during the Telecommunications chapter; while Database Administrator interviews are discussed while covering the database chapter.

Once the interview subjects have been approved, students begin their company research. Using the World Wide Web, they explore the company history—both financially and culturally if possible. They may also obtain more information regarding the job title of the interviewee to ask informed IS-related questions. Web site evaluation is another required assignment in the course, and if the company has a public web site, students may choose to evaluate the site using criteria developed in class. Once their research is complete, students must type a brief (one page is fine) synopsis of the company and include a works cited page.

Students present their interview results in groups. The day of their presentation, they must have the interview form completed, a PowerPoint presentation of the interview details, and all other supporting documentation. The scheduled presenters gather in the front of the room and each presents for about seven minutes. Typically, there are no more than five students in each group, so the first phase takes about a half hour. After all the students have presented, there is an open forum for discussion. The formal presentation portion is used to present the factual parts of the interview (i.e., the structured section). The open forum begins with students sharing the information they gleaned from the unstructured portion. These forums typically generate an active class discussion.

Student response to the interview exercise has been overwhelmingly positive. Many students mention the assignment specifically on their end of semester evaluation forms as being the one from which they learned the most. As was demonstrated above, the interview assignment is extremely valuable to the student for a number of reasons:

- It involves students in a real world situation
- It provides students with useful interviewing skills
- It allows students to participate in a research project
- It provides students with an opportunity to analyze a web site
- It affords students an opportunity to hone verbal and written communication skills
- It requires students to use computer skills learned previously (e.g. PowerPoint)
- It strengthens the university relationship with the business community

One unexpected benefit of the interview has been in job placement services. One student interviewed three professionals in different IS areas. He felt he had learned so much about possible employment from the first interview that he would conduct more. By doing so, he was able to glean great insight into the various career paths available to him. Several students have been offered jobs by the people they interviewed; some others have taken semester-long internships working with the people they met during the assignment.

The interview exercise is also quite valuable to the instructor, the MIS department, and even the business school. The interviews generate a vast amount of data that can be analyzed and reported upon in later research projects. Issues such as work environment, turnover rates, and job satisfaction have all been covered in interviews. Thus, faculty can benefit from the research papers the interviews produce. The interviews have also provided information as to the issues the professional see as important for business students. Thus, the interviews tap into an information source that departments and schools can use as a first source for decisions regarding course and curriculum issues. Further, because the students are out in the community, the interview process can raise the visibility of the IS program and establish a link to the business community.

MAJOR INSIGHTS AND LESSONS LEARNED BY STUDENTS

While the data gathered in these interviews has provided the authors with a wealth of information for other research efforts, the primary purpose of this paper was not to share the results of the interviews. Still, the students' insights and lessons learned are germane to a discussion of the value of the exercise. In this section, the authors present some of those lessons.

Students were most surprised by the consistent level of job satisfaction of the IS employees versus the number of hours worked. In interview after interview, subjects reported that they were satisfied with their jobs, despite long working hours. While the average work week for the IT professionals was over 50 hours, most reported being at least somewhat satisfied with their jobs. Moreover, all but eleven of the interview subjects were required to spend time on-call, typically one week every six weeks.

Another surprising aspect of the interviews was the number of subjects who told the students not to make money their first priority in finding a job. While the goals and objectives (other than financial) varied greatly among the interviewees, some of the areas mentioned included: finding a firm that will offer a broad range of experiences, working for a company that allows you to stay current with respect to IT skills, and doing something you enjoy.

One interview question specifically targeted the IS majors. These students were surprised to learn some of the advice the interviewees had for them: learn a broad range of skills, knowing technology is never enough, and focus on the training you will receive rather than the salary. Among the skills deemed important to IT professionals were: communications (both verbal and written), strong business background, project management, general management skills, and team work skills.

CONCLUSIONS

The interview exercise serves a multitude of purposes in the introductory MIS class. It offers the students a chance to improve interviewing, writing, and presentation skills. Further, students actively participate in a research project. It provides the instructor with valuable research data, and it establishes a link between the business school and the IS community. Insights gained from the interviews can be used to generate class discussion and assist students in their search for the appropriate career.

REFERENCES

Cantor, J. (1997). Experiential Learning in Higher Education, Linking Classroom and Community. *ASHE-ERIC Higher Education Report No. 7*, Washington DC.

Clements, A. (1995). Experiential-Learning Activities in Undergraduate Developmental Psychology," *Teaching of Psychology* 22(2): 115-18.

Dewey, J (1916). Democracy and Education, MacMillan NY

Dick, G., and Jones, S., (1995). "Exposure to Workplace Issues While at University: Giving Students an Edge". Proceedings of the 10th Annual Conference of the Academy for Information Management, New Orleans, LA, p. 110 - 120.

Matson, L. and Matson, R (1995). "Changing Times in Higher Education: An Empirical Look at Cooperative Education and Liberal Arts Faculty," *Journal of Cooperative Education* 30(3): 13-24.

O'Hara, M. and Stephens, C. (1999a). "Preparing Students for the Next Millennium". Proceedings of the 2nd Annual Southeast Association for Information Systems.

O'Hara, M. and Stephens, C. (1999b). "The Required IT Management Course In AACSB Curriculums: A Comparison Of the Undergraduate and MBA Course". Proceedings of the 14th Annual Conference of the Academy for Information Management, Charlotte, NC, p. 264-273.

Rogers, Carl (1995). On Becoming a Person, Houghton Mifflin Co, NY.

Stephens, C. and O'Hara, M. (1998). "Information Technology for Rising Executives: MBA Curriculums at AACSB Accredited Schools". Proceedings of the 13th Annual Conference of the Academy for Information Management, Helsinki, Finland, pp.63-75.

APPENDIX A
THE INTERVIEW

CISM INTERVIEW WITH IT PROFESSIONAL

Name: ______________________
Job Title: ______________________
E-Mail: ______________________
Phone: ______________________

Company: ______________________
Mailing address: ______________________
____
____

PART I: STRUCTURED INTERVIEW

Section 1: IT Profession

1. How many years have you been in an information systems or information technology job?______
2. How many IT job changes have you experienced with your present firm?______
3. How many company changes have you experienced while in an IT job?______
4. How many geographic relocations have you experienced while in an IT job?______
5. What were the major reasons for job changes? (within same firm)?

____
____
____
____

6. For company changes?

____
____
____

7. What are the five key (general business) knowledge areas for today's information systems majors?

1. ______
2. ______
3. ______
4. ______
5. ______

8. What are the 5 key (technology) skill sets for today's information systems majors?

1. ______
2. ______
3. ______
4. ______
5. ______

9. What do you believe to be the 5 key issues facing IT professionals today?

1. ______
2. ______
3. ______
4. ______
5. ______

10. What are the three major ways you keep your IT knowledge and skills current?

1. ______
2. ______
3. ______

11. Which level of management support for keeping current best describes your situation?

1-none 2-very little 3-some but inadequate 4-adequate 5-good 6- very good 7- excellent

12. What advice would you give an information systems major who has just graduated and is seeking a job in the field?

______
______
______
______
______
______

Section 2: Job Satisfaction

1. What is the average number of hours you work per week?______

2. What is the range of hours per week B a maximum and minimum?______

3. Are you on call? If so, what is your on call schedule?____

4. Which description best fits your level of job satisfaction:

1- very dissatisfied 2- dissatisfied 3- somewhat dissatisfied 4- neutral
5-somewhat satisfied 6- satisfied 7- very satisfied

Section 3: Work Environment
(student observation if interview done face-to-face; ask if telephone interview is conducted)

1. Office or cubicle?______

2. If office, high wall or low wall?______

3. Approximate size?______

4. Which phrase best describes the sound level?

1-loud and distracting 2-frequently distracting 3-occasionally distracting
4-not noticeable 5-other noise does not penetrate work area

5. Are there headsets for listening to music?______

6. Is there a window? If so, describe the view (natural scenery, industrial view, pavement, etc.)____

7. If so, does the window open?______

8. Is there natural light?______

9. Describe the lighting fixtures (glare/non-glare; fluorescent and/or area lighting, etc.)____

10. What amenities are present?
______ guest chairs
______ conference table
______ decorative items (wall hangings, diplomas, etc)
______ personal souvenirs and photographs (brief description)____________________________________
______ others (please describe) ____

11. (For students to complete) Would you want to work in this environment? Why or why not?

Part II: UNSTRUCTURED INTERVIEW

For this part of the interview, you may ask the IT professional any questions you want. They should be open-ended questions so that you obtain rich information rather than simple "yes or no" answers.

Try to ask questions that flow from information you may have learned in the first part of the interview.

EVALUATING PROCEDURAL KNOWLEDGE IN INFORMATION SYSTEMS STUDENTS

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Jim Nohelty
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Anderson (1982, 1993) proposed that individuals progress from possessing declarative knowledge to possessing procedural knowledge as they acquire cognitive skills. Since cognitive skill acquisition is an important part of an information systems (IS) education, it is proposed that evaluating IS students on both declarative and procedural knowledge within skill domains will provide several educational benefits to students and educators. This initial study examined whether an objective format (i.e., multiple-choice) examination on data modeling could discriminate between declarative and procedural knowledge in IS students. The subjects for the study were IS students in two different courses. One of those courses was a prerequisite for the other course, so students had had different levels of experience with data modeling. The results indicated that there was a significant difference in the performance of the subjects in both classes between the questions testing declarative knowledge and those testing procedural knowledge. Also, while there was no significant difference between the two classes in their performance on declarative-type questions, there was a significant difference in their performance on procedural-type questions. These results provide initial evidence that an objective format examination can discriminate between the two types of knowledge, providing educators and students with insight into the students' acquisition of the cognitive skills being taught.

INTRODUCTION

Information Systems (IS) professionals are required to display a wide range of skills (Cheney, Hale and Kaspar, 1990; Dwight, 1993; Lee, Trauth and Farwell, 1995, Leitheiser, 1992; Misic, 1996; Prabhaker, Litecky and Arnett, 1996), and most of these skills tend to be cognitive in nature. As educators of IS professionals, we need to be able to develop each of these skills in our students through instruction and evaluation. Cognitive skill acquisition theory was consulted to provide guidance in the evaluation of IS students' cognitive skills.

Cognitive skill acquisition theory (Anderson, 1982, 1993) proposes that cognitive skills are acquired through a process of moving from declarative knowledge to procedural knowledge. As a student begins to acquire a new cognitive skill, declarative knowledge in the form of facts and examples is stored in memory. Examples consist of problems specific to the skill domain, as well as the steps taken to solve those problems (VanLehn, 1996). When students attempt to solve problems on their own, they search for an analogous example. They then use that example's solution to arrive at their own solution for the problem on which they are currently working. This initial mode of problem solving has been shown to be more tedious and to require more time than the problem solving demonstrated by experts (Anderson, 1993).

As problems are solved, students are able to compile this initial declarative knowledge into procedural knowledge. Procedural knowledge consists of knowing how to perform a certain skill. Because it consists of psychomotor or cognitive actions, it is difficult to describe procedural knowledge in verbal or written form. Verbal or written descriptions should not be equated to the procedural knowledge they describe. Reading a description of procedural knowledge does not provide one with that procedural knowledge. Either the person reading the description already possesses the procedural knowledge and knows how to apply that which has been read, or the person must still acquire the knowledge through experience in performing the skill.

Evaluations that help to establish an IS student's possession of declarative and procedural knowledge could be used to prescribe future training and classroom exercises. Any deficiencies in declarative knowledge could be addressed by further instruction in the conceptual basics of the skill domain. Deficiencies in procedural knowledge would indicate a need for further experience in using the skill. Knowing which production rules are deficient would aid in providing activities that would help to develop those specific production rules.

The purpose of this study is to examine whether procedural knowledge in IS students can be evaluated with an objective examination format. A multiple-choice format was chosen for the instrument because multiple-choice tests have been used in the past for cognitive testing (Haladyna, 1999), and because of their objective nature.

RESEARCH QUESTION

Examinations that are based on the dichotomy between declarative and procedural knowledge have the potential for several benefits for both instructors and students in IS. These benefits include a better understanding of the student's progress in acquiring the skill and an ability to objectively evaluate the student's progress. This initial study therefore asks the following research question: *Is an examination in an objective format (e.g., multiple choice) capable of differentiating between declarative and procedural knowledge in IS students?*

Research has demonstrated that novices tend to possess declarative knowledge and lack procedural knowledge (Glaser, 1990), while experts possess procedural knowledge, as well as declarative knowledge (Glaser and Bassok, 1989). Subjects were taken from two undergraduate classes that teach data modeling: Systems Analysis and Design (SAAD) and Database Design and Administration (DDAA). There should be no significant difference between the two classes in terms of declarative knowledge because each of the subjects had received instruction in data modeling when they completed the examination. On the other hand, the more advanced class (DDAA), should outperform the less advanced class (SAAD) on items that examine procedural knowledge, since the students in the more advanced class will have had more opportunities to develop procedural knowledge.

Anderson's Adaptive Character of Though-Rational (ACT-R) theory (1982, 1993) provided the basis for the three hypothesis tests given in Table 1. μ_{Dec} is the mean percent correct on the declarative questions, μ_{Proc} is the mean percent correct on the procedural questions, $\mu_{DecDDAA}$ is the mean percent correct on the declarative questions for the Database Design and Administration course, $\mu_{DecSAAD}$ is the mean percent correct on the declarative questions for the Systems Analysis and Design course, $\mu_{ProcDDAA}$ is the mean percent correct on the procedural questions for the Database Design and Administration course, and $\mu_{ProcSAAD}$ is the mean percent correct on the procedural questions for the Systems Analysis and Design course. The first hypothesis test compares the overall performance on the questions testing declarative knowledge to the questions testing procedural knowledge. The second and third hypothesis tests compare the performance between the two classes on either the declarative questions (the second hypothesis test) or the procedural questions (the third hypothesis test). It is expected that the first and third hypotheses will have significant results, while there will be no significant results with the second hypothesis.

TABLE 1
HYPOTHESIS TESTS

Test	Expected Results
H_{1o}: $\mu_{Dec} = \mu_{Proc}$ H_{1a}: $\mu_{Dec} > \mu_{Proc}$	Significant
H_{2o}: $\mu_{DecDDAA} = \mu_{DecSAAD}$ H_{2a}: $\mu_{DecDDAA} > \mu_{DecSAAD}$	Not significant
H_{3o}: $\mu_{ProcDDAA} = \mu_{ProcSAAD}$ H_{3a}: $\mu_{ProcDDAA} > \mu_{ProcSAAD}$	Significant

METHODOLOGY

Development of the instrument began by surveying subject matter experts to determine the minimum level of knowledge and skills needed by a systems analyst to be able to produce data models on the job. To develop the survey, standard textbooks in the areas of systems analysis and design (Fertuck, 1995; Hoffer, George and Valacich, 1999; Kendall and Kendall, 1999; Whitten and Bentley, 1998) and database design (McFadden and Hoffer, 1991; Sanders, 1995) were consulted. Definitions, concepts and processes for data modeling given in each of these textbooks were listed.

The list of 81 items obtained from the text books (Appendix A) was then given to nine subject matter experts and they were asked to consider the *minimum* level of knowledge and skills an employee in an entry-level data modeling job would need to complete three common tasks in data modeling. The three tasks were drawing entity relationship diagrams, completing a repository for those diagrams, and using a computer-aided software engineering (CASE) tool to draw the diagrams and complete the repository. The subject matter experts were asked to rate each item in the list on a 5-point Likert scale (where 1 was "Very low" and 5 was "Very high") based on the following question in relation to those three tasks.

> *How important is it that the employee described above possesses this knowledge or skill when working on the above three tasks?*

Seven of the nine subject matter experts returned completed surveys. The results are provided in Appendix B. Items with an overall median importance of less than 3.0 (the midpoint of the scale) were dropped from further consideration. Items with a median importance of between 3.0 and 4.0 were carefully considered to determine whether their elimination would adversely affect the coherence of the training. Items that were dropped include those that pertained to logical and physical models; enterprise data models; database models (i.e., hierarchical, network, and relational); supertypes and subtypes; normal foms other than first, second, or third; and business rules. Also, the subject matter experts identified two additional items that were added to the list (the last two items listed in Appendix A).

Based on the resulting list, the instrument was developed. There are two types of questions on the instrument: those that test declarative knowledge and those that test procedural knowledge. The declarative knowledge questions were written based on standard definitions for constructs in data modeling and reasons for the importance of these constructs.

The procedural knowledge questions required writing questions based on the production rules behind completing specific subtasks in data modeling. For example, a typical subtask in data modeling is *achieving second normal form*. Each subtask will have multiple production rules, depending on the expertise of the individual (Anderson, 1993). One possible production rule for this subtask would be:

> *If an entity that is in first normal form possesses a compound primary key and if every nonkey attribute is fully functionally dependent on the primary key, then note that that entity is in second normal form.*

This production rule represents a subgoal for the overall task of achieving second normal form, namely the subgoal of identifying whether an entity is in second normal form. An individual would need to possess additional production rules for modifying an entity that is not in second normal form so that it achieves second normal form.

The following is an example of a question that could be asked to test whether an individual is able to identify entities in second normal form.

Which of the following entities is in second normal form?

a. An Employee entity that tracks the phone numbers that belong to each employee. There may be anywhere between 1 and 4 phone numbers. The attributes include Employee ID, Last Name, First Name, Department, and Phone Number.

b. An Employee Skill entity that tracks the skills possessed by each employee. The attributes include Employee ID and Skill ID.

c. An Employee Skill entity that tracks the skills possessed by each employee. The attributes include Employee ID, Skill ID and Skill Description.

d. Both a and b.

A total of 105 questions were written for the instrument. Multiple questions were written for each of the items listed in Appendix A except for the items concerning the use of a CASE tool. A single question was written for those items to limit the redundancy of the instrument. Five of the original questions were dropped because they appeared ambiguous or confusing in relation to other questions on the exam. An additional question was dropped because the answer was obvious, leaving a total of 99 questions. Forty-five of those questions tested declarative knowledge, and 54 questions tested procedural knowledge. The questions were rearranged so they appeared in random order.

Subjects consisted of 60 undergraduate IS students at a large southeastern university in North America. The students were taken from two different classes: Systems Analysis and Design (23 students) and Database Design and Administration (37 students). Systems Analysis and Design is one of two initial courses in the IS major at this university and is a prerequisite to the Database Design and Administration course. At the time the instrument was administered, students in the Systems Analysis and Design course had just completed the classes that introduced them to data modeling. Students in the Database Design and Administration course had completed the data modeling portion of the course when the instrument was administered. Therefore, students in both courses had received instruction on data modeling, but the students in the Database Design course had more experience in actually constructing data models. The students were given extra credit for participating in the study and they received individual reports after completing the examination that listed areas of data modeling where they had given incorrect answers.

Students were not given advance notice about completing the instrument. All of the Systems Analysis and Design students completed the instrument during a single class period. Most of the Database Design and Administration students (27) completed the instrument also during a single class period. A second section of the Database Design class was given the opportunity to complete the instrument outside of class. Ten students from the second section of the class completed the instrument under controlled conditions. No significant differences were found between the performance of those ten students and the rest of the Database Design students. Because the Systems Analysis and Database Design classes are taken at different times during the major, students in the two classes generally do not know each other.

RESULTS

Descriptive statistics for each class are presented in Table 2. It was unexpected that both classes would achieve similar averages; although the range for the Database Design class was slightly wider, with students achieving a higher maximum score. Table 3 presents descriptive statistics for the instrument broken down by the questions testing declarative and procedural knowledge. As hypothesized, the mean scores for the declarative questions are higher than the corresponding scores on the procedural questions.

TABLE 2
DESCRIPTIVE STATISTICS FOR THE PERCENTAGE CORRECT BROKEN DOWN BY CLASS

	Average	Standard Deviation	Median	Maximum	Minimum
SAAD	57.00	8.44	58.00	70.00	42.00
DDAA	59.65	9.29	59.60	80.81	43.43
Overall	58.63	8.99	59.30	80.81	42.00

TABLE 3
DESCRIPTIVE STATISTICS FOR THE PERCENTAGECORRECT BROKEN DOWN BY TYPE OF QUESTION

	Average	Standard Deviation	Median	Maximum	Minimum
Declarative	68.04	11.63	68.89	88.89	44.44
Procedural	50.50	9.56	50.00	74.07	33.33
Overall	58.63	8.99	57.78	88.89	33.33

The first hypothes is was tested using a paired hypothesis test. For each of the 60 students, the percent correct for the procedural questions was compared to the percent correct for the declarative questions. The only assumption for this type of test is that the sample size is sufficiently large (Sincich, 1991). The sample size is based on the number of students that completed the instrument (60 students), which is well above the accepted guideline of a sample size of 30 (Sincich, 1991).

The next two hypothesis tests were large sample, two population mean hypothesis tests. For the second hypothesis test, the mean percentage correct on the declarative questions within one class was compared to the mean percentage correct on the declarative questions within the other class. The third hypothesis test was similar except that the mean percentage correct on the procedural questions was compared between the two classes.

There are two assumptions associated with two population mean hypothesis tests (Mendenhall and Sincich, 1993): that both samples are randomly and independently selected, and that the two sample sizes are sufficiently large. The two classes were randomly selected out of several possible sections offered for each class during a semester. Because one class (Systems Analysis and Design) is a prerequisite of the other class, the population of students taking one of the classes during a given semester should be a different set of students than the population of students taking the other class during that semester. Thus, the selection of students in each of the two classes was independent of the other. The sample size for the declarative questions is 45 and the sample size for the procedural questions is 54, indicating that the sample sizes are large enough (Sincich, 1991). Therefore, both of the assumptions appear to be satisfied.

The results of the three hypothesis tests are summarized in Table 4. Because this is an initial study, each test was performed at a 90% significance level. Based on the results of the first hypothesis test, it appears that there is a significant difference in the performance of subjects between the declarative and procedural questions. The second test failed to indicate a significant difference in the performance between the classes on declarative questions and the third test indicated that those subjects with more experience in data modeling performed better at the procedural questions.

DISCUSSION AND LIMITATIONS

Based on the results of the hypothesis tests presented in Table 4, it appears that there is a significant difference in the performance of subjects between the declarative and procedural questions and that those subjects with more experience in data modeling perfomed better at the procedural questions. These results provide initial

TABLE 4
SUMMARY OF THE RESULTS OF THE HYPOTHESIS TESTS

Hypothesis Test	Test Statistic	Significance	Conclusion at $\alpha=0.10$
H_{1a}: $\mu_{Dec} > \mu_{Proc}$	$z = 12.51$	$p = 0.00$	Reject H_o
H_{2a}: $\mu_{Dec4212} > \mu_{Dec3113}$	$z = -0.46$	$p = 0.68$	Fail to reject H_o
H_{3a}: $\mu_{Proc4212} > \mu_{Proc3113}$	$z = 1.38$	$p = 0.08$	Reject H_o

evidence that the instrument can discriminate between the declarative and procedural types of knowledge.

While it has been demonstrated that there is a significant difference in the performance of students on the two types of questions, it is still unclear whether this is because procedural knowledge is being evaluated. Other competing explanations for the difference in performance could include students' unfamiliarity with this form of testing, or that the questions are testing two different constructs, not necessarily declarative and procedural knowledge. Future research could address this limitation by correlating student performance on this type of examination with their performance on actual data modeling tasks, or by comparing performance on this type of examination with standard forms of mental model measurement (Kraiger, Salas and Cannon-Bowers, 1995).

Also, production rules were chosen randomly as the examination was developed. Future work could establish a more complete library of production rules within a cognitive skill domain. Instructors could then develop examinations using these libraries, ensuring that the complete skill domain is represented by questions on an examination.

Evaluating procedural knowledge on an objective basis can potentially provide students and educators with a better understanding of students' acquisition of IS skills. The results from this study are encouraging, but more work is clearly still needed. The limitations described above need to be addressed, and a better understanding of evaluating procedural knowledge in IS students needs to be developed.

REFERENCES

Anderson, J. R. (1982) Acquisition of a cognitive skill. *Psychological Review*, 89, 369-406.

Anderson, J. R. (1993) *Rules of the Mind*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Cheney, P. H., Hale, D. P., and Kaspar, G. M. (1990) Knowledge, skills and abilities of information systems professionals: Past, present and future. *Information & Management*, 19 (4), 237-248.

Dwight, D. (1993) Hard demand for soft skills. *Datamation*, 39 (2), 28-32.

Fertuck, L. (1995) *Systems Analysis & Design with Modern Methods*. Dubuque, IA: Wm. C. Brown Communications, Inc.

Glaser, R. (1990) The reemergence of learning theory within instructional research. *American Psychologist*, 45, 29-39.

Glaser, R. and Bassok, M. (1989) Learning theory and the study of instruction. In M. R. Rosenzweig and L. W. Porter (Eds.), *Annual Review of Psychology: Vol. 40* (pp. 631-666). Palo Alto, CA: Annual Reviews, Inc.

Haladyna, T. M. (1995) *Developing and Validating Multiple-Choice Test Items*. Mahway, NJ: Lawrence Erlbaum Associates.

Hoffer, J. A., George, J. F. and Valacich, J. S. (1999) *Modern Systems Analysis and Design* (2nd ed.). Reading, MA: Addison Wesley Longman, Inc.

Kendall K. E. and Kendall, J. E. (1999) *Systems Analysis and Design* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Kraiger, K., Salas, E., and Cannon-Bowers, J. A. (1995) Measuring knowledge organization as a method for assessing learning during training. *Human Factors*, 37 (4), 804-816.

Lee, D. M. S., Trauth, E. M. and Farwell, D. (1995) Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation. *MIS Quarterly*, 19 (3), 313-340.

Leitheiser, R. L. (1992) MIS skills for the 1990s: A survey of MIS managers' perceptions. *Journal of Management Information Systems*, 9 (1), 69-91.

Mendenhall, W. and Sincich, T. (1993) *A Second Course in Business Statistics: Regression Analysis* (4th ed.). Englewood Cliffs, NJ: Dellen Publishing Company.

McFadden, F. R. and Hoffer, J. A. (1994) *Modern Database Management* (4th ed.). Redwood City, CA: The Benjamin/Cummings Publishing Company, Inc.

Misic, M. (1996) The skills needed by today's systems analysts. *Journal of Systems Management*, 47 (3), 34-41.

Prabhaker, B., Litecky, C., and Arnett, K. (1996) A longitudinal analysis of job skill trends in the MIS job market. *Proceedings of the Americas Conference on Information Systems*, 338-340.

Sanders, G. L. (1995) *Data Modeling*. Danvers, MA: Boyd & Fraser Publishing Company.

Sincich, T. (1991) *A Course in Modern Business Statistics*. San Francisco: Dellen Publishing Company.

VanLehn, K. (1996) Cognitive skill acquisition. In xxx (Ed.), *Annual Review of Psychology: Vol. 47* (pp. 513-539). Palo Alto, CA: Annual Reviews, Inc.

Whitten, J. L. and Bentley, L. D. (1998) *Systems Analysis and Design Methods* (4th ed.). Boston, MA: Irwin/McGraw-Hill.

APPENDIX A
DATA MODELING CONSTRUCTS AND PROCESSES

1. Data model definition
2. Need for data models
3. Importance of data modeling within the systems development lifecycle
4. Logical and physical data model definition
5. Need for logical/physical data models
6. Enterprise data model definition
7. Need for enterprise data models
8. Definitions of database models (e.g., hierarchical, network, relational)
9. Historical use of database models
10. Definition of entity relationship diagrams
11. Definition of entities
12. Definition of relationships
13. Determining entities
14. Determining which entities are related to each other
15. Definition of cardinality
16. Determining the cardinality of a relationship
17. Definition of the degree of a relationship
18. Determining the degree of a relationship
19. Definition of an associative entity/gerund
20. Determining entities that are gerunds
21. Definition of categorization/generalization
22. Definition of supertypes and subtypes
23. Determining entities that are supertypes and subtypes
24. Definition of a repository
25. Need for a repository
26. Definition of attributes
27. Determining the attributes for an entity
28. Definition of fields and records
29. Definition of functional dependencies and determinants
30. Identifying functional dependencies between attributes
31. Definition of primary keys
32. Determining the primary keys for entities
33. Definition of compound keys
34. Identifying compound keys
35. Definition of foreign keys
36. Reasons for foreign keys
37. Identifying foreign keys
38. Definition of multivalued attributes
39. Identifying multivalued attributes
40. Resolving multivalued attributes
41. Definition of aliases for attributes
42. Need for aliases of attributes
43. Definition of data type (in relation to attributes)
44. Determining the data type of attributes
45. Definition of domains (limits and range checks for attributes)
46. Determining the domain of an attribute
47. Definition of normalization
48. Reasons for normalization
49. Definition of first normal form
50. Achieving first normal form
51. Definition of second normal form
52. Achieving second normal form
53. Definition of third normal form
54. Achieving third normal form
55. Definition of fourth normal form
56. Achieving fourth normal form
57. Definition of fifth normal form
58. Achieving fifth normal form
59. Definition of Boyce-Codd normal form
60. Achieving Boyce-Codd normal form
61. Definition of domain-key normal form
62. Achieving domain-key normal form
63. Definition of CASE tools
64. Uses for CASE tools
65. Starting a new project in a CASE tool
66. Starting a new ERD in a CASE tool
67. Placing entities on a diagram in a CASE tool
68. Describing relationships between entities on a diagram in a CASE tool
69. Saving an ERD in a CASE tool
70. Printing an ERD in a CASE tool
71. Analyzing an ERD for syntactical errors using a CASE tool
72. Finding the repository in a CASE tool
73. Navigating through the repository in a CASE tool
74. Describing the data types of attributes in the repository of a CASE tool
75. Describing the domains of attributes in the repository of a CASE tool
76. Definition of business rules
77. Reasons for documenting business rules
78. Documenting business rules in a CASE tool
79. Checking that all key information is correctly identified for a data model
80. Generating SQL code from an ERD and repository in a CASE tool
81. Printing reports on the repository in a CASE tool
82. Need for domains*
83. Adding attributes in a CASE tool repository*

* Items added by subject matter experts.

APPENDIX B
RESULTS OF DATA MODELING SURVEY, RANKED BY MEDIAN VALUE

	Importance	
Item	Mean	Median
10	4.67	5
11	4.50	5
12	4.67	5
13	4.50	5
14	4.67	5
17	4.50	5
18	4.67	5
19	5.00	5
20	4.83	5
24	4.33	5
26	4.67	5
27	4.67	5
31	4.67	5
32	4.83	5
36	4.67	5
37	4.67	5
52	4.17	5
54	4.17	5
63	4.33	5
64	4.83	5
65	4.67	5
66	4.67	5
67	4.67	5
68	4.67	5
15	4.33	4.5
16	4.50	4.5
25	4.33	4.5
28	4.00	4.5
33	4.50	4.5
34	4.50	4.5
35	4.50	4.5
39	4.50	4.5
43	4.33	4.5
44	4.33	4.5
47	3.83	4.5
48	3.83	4.5
49	3.83	4.5
50	4.00	4.5
51	3.83	4.5
53	3.83	4.5
69	4.33	4.5
70	4.17	4.5
71	4.33	4.5
72	4.33	4.5
74	4.33	4.5
75	4.33	4.5
81	4.00	4.5
4	4.00	4
21	3.67	4
22	3.83	4
23	3.83	4
38	4.33	4
40	3.83	4
45	4.00	4
46	4.00	4
73	4.00	4
77	3.67	4
79	3.40	4
1	3.50	3.5
5	3.83	3.5
76	3.50	3.5
78	3.33	3.5
2	3.67	3
3	3.67	3
6	2.67	3
7	2.67	3
29	2.67	3
30	2.83	3
41	3.33	3
42	3.17	3
8	2.33	2.5
80	2.67	2.5
9	2.33	2
55	1.83	2
56	2.00	2
59	2.00	2
60	2.17	2
57	1.67	1.5
58	1.83	1.5
61	1.83	1.5
62	2.00	1.5

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WISDOM AND THE IS CURRICULUM: IS ETHICS NECESSARY?

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ABSTRACT

Technology and the associated scientific theory do not contain within themselves a theoretical base to guide if, why and how they might be wisely used (other than, of course, technical instructions). Ethics units in the IS curriculum are required to help promote and develop appropriate human wisdom, particularly in a technological culture where mechanistic conceptions may trivialise the dignity of the human person. Wisdom in the Platonic sense, is knowledge of what is, of what is real, of what actually is the case. It is knowledge of the real world as distinct from the world of the legal, of conventions, or of appearances, the world which appears to be the case. In its practical aspects (ethics) it is a knowledge of the purpose of human life, human happiness and well being, and of the means to attain that end. In its speculative aspects, it views all that exists as a rationally ordered and harmonious whole. Socrates is wise in that he is committed to the world which is the case. In this he is involved in the pursuit of wisdom and may be truly called a philosopher. We therefore argue that without an ethical perspective, various humanly devaluing philosophies may be accepted by default. Detectable, for example, in technological thinking is the materialist philosophy of mechanism. In fact, by default, science often assumes a mechanistic philosophy leading to a materialism devoid of ethics, which grew out of the origins of modern science. The discourse of artificial intelligence studied in IS units is used to illustrate these issues.

INTRODUCTION

Though not always clearly defined, the concepts of data, information, and knowledge are central to the design of Information Systems (IS). They represent an ascending order of complexity where data consisting of raw facts become meaningful as patterns in blocks of data and so information expressed as propositions. When propositions are meaningfully joined, as in cause-and-effect relations, knowledge is produced. When present in an information system, data and, information exist without meaning; meaning becomes present only to the rational observer. Beyond these there is the further concept of wisdom which exists both as a criteria for the use of IS in its various forms, and as an essential quality of an educated person. Most generally, wisdom refers to the capacity of decision makers to recognise and apply values in such a humane way that human beings and their environment to flourish. Thus, wisdom also includes an awareness of the inestimable dignity of each human person beyond reason or merit, possessing inalienable rights, being ends in themselves, and experiencing inner lives rich in feelings, memories, thoughts and emotions.

The paper argues for the place of ethics in the IS curriculum to detect humanly devaluing philosophies underlying the discourse and claims of technology. The project of artificial intelligence (AI) is used as a case study as the technology makes many assumptions about its ultimate goals and the nature of the human person.

WISDOM

Wisdom is a concept originating in the ancient Near East. Egyptian examples of wisdom literature date back to 3rd millennium BC, whilst the Hebrew wisdom movement flourished under King Solomon (961-922 BC). Wisdom was thought to be an acquired quality or special kind of knowing about life's meaning applicable to the successful living of daily life and attainable by those who seek it by patient reflection on experience. In another mystical sense it is an intuitive form of knowledge beyond the effort of thought, attainable as a gift by those who desire it. Wisdom assumes importance in the Western tradition of philosophy in the life of Socrates (470-399 BC).

The wisdom, which the philosopher seeks, relates especially to the Socratic doctrine that virtue is knowledge. This means that none could realise the best in themselves and thereby become happy unless they knew clearly, as is appropriate for a rational being, what life is worth living for (Cornford, P175), the true meaning of life. This is provided by the highest object of knowledge, the essential nature or form of the "Good," from which everything that is good and right derives its value for us (Republic, vi 504), and which is the final cause of all that is good in the universe, even of its very existence. From the vantage-point of a knowledge of the Good, the whole of reality, including the moral and physical order is seen as an objective rational system (Cornford, P212). As the object of a purpose attributed to a divine Reason operating in the world, this supreme Good makes the world intelligible, just as a work of human craftsmanship becomes intelligible when we see the purpose it is designed to serve. Such knowledge, once attained, cannot fail to determine will and action since all desire what is good.

The essence of the doctrine of forms (whatever of Plato's two world's mode of expressing it) is the conviction (showing remarkable similarity to the Biblical account) that:

- the world is good as its very existence as all that exists partakes of the form of the Good;
- the world and all that exists is ordered and is thereby intelligible;
- life has a purpose which is knowledge or wisdom of the Good, and living accordingly;
- there is a final justice since "nothing can harm a good man, either in life or in death; nor are his fortunes neglected by the gods" (Aplogy, 41d);
- there is a unique dignity for the human person among the things which exist given that "the soul is immortal and never perishes" (Republic, x, 608d);
- the differences between good and evil, right and wrong, true and false, beautiful and ugly, are absolute, not relative to the customs or tastes or desires of individuals or social groups (Cornford, p180).
- there are objective and necessary truths. Good and evil, and so ethics, are discovered by rational reflection by the intellect rather than invented; they are not of our creation as are the legal or conventional and the illegal;

Wisdom is here understood, therefore, to be a view of the world that assumes that there is an overall intelligible order in the universe which has meaning for human life, and has some form of goodness as its basis. Thus, there is to be found a harmony between all aspects of human existence including thought and behaviour, and the underlying first principles of the cosmos. There is, further, a fundamental dignity attributed to the human person that exists beyond all reason and merit.

While ethical discourse tends to focus on the distinction between ethical and unethical behaviour, with a view to avoiding the latter, wisdom is further understood to imply an ability and desire to choose, from among ethical behaviours. That is, a mode of behaviour which might best respect the true meaning of human existence and so promote flourishing of the dignity of all human persons.

APPLICATION OF WISDOM TO IS

Philosophers, who commit themselves with passion to seek the Good and who are necessarily few in number, are those most appropriate to rule in the ideal state (P231). In the philosopher king of Plato's Republic, there would be union of political power and love of wisdom. In such a person there will be the supremacy of reason, the divine element in man, over the rest of our nature. (P176) Rather than being free to do whatever he liked, the philosopher king would be like an artist working with constant reference to an unchanging model (the forms such as justice, goodness, and temperance) which irrevocably determines the outline and basic principles of his work (P 205). In contemplating a world of unchanging and harmonious order, where reason governs and nothing can do or suffer wrong; he will not fail to fashion himself in its likeness.

For our own times, Plato's rulers might well include those who provide the world with computer technology and other forms of mass communication which have so transformed modern living beyond the powers of national governing bodies. The need for philosopher-kings might now equate with the need for a guiding philosophy for those constructing, using and discoursing on the artefacts of technology; they also need to be philosophers in the Platonic sense of being committed to the pursuit of wisdom.

ETHIC UNITS IN THE IS CURRICULUM

In its practical aspects, wisdom, assuming an objective moral order, gives direction to human practical and ethical activities, provides an ability to order one's life well, and leads to a good and happy life. In its speculative aspects wisdom strives to grasp first principles, asking the metaphysical "why" questions. It judges and orders less universal disciplines. Science, for example, simply accepts rather than critiques its own first principles (assumptions about an orderly universe and about human knowing). Neither does science advise on the proper or best use of the technology to which it gives rise.

Technology and the associated scientific theory do not contain within themselves a theoretical base to guide if, why and how they might be wisely used (other than, of course, technical instructions). Ethics units in the IS curriculum are required to help promote and develop appropriate human wisdom, particularly in a technological culture where mechanistic conceptions (what appears to be the case) may trivialise the dignity of the human person. Without an ethical perspective, various humanly devaluing philosophies may be accepted by default. Detectable, for example, in technological thinking is the materialist philosophy of mechanism. In fact, by default, science often assumes a mechanistic philosophy leading to a materialism devoid of ethics, which grew out of the origins of modern science.

MECHANISM:
WHAT SEEMS TO BE THE CASE

Modern science finds its origins in the 16th and 17th centuries. During this significant period, Bacon (1588-1679) proposes the scientific method, Galileo (1564-1632) explains natural phenomena (using efficient causes and matter in motion), Descartes (1594-1650) employs the method of mathematics (requiring clear and simple ideas as axioms), and Newton (1632-1704) provides a comprehensive system of mechanics based on mathematical laws governing the behaviour of conceptual models (particles with mass concentrated at a point).

Newton discovered that the movements of natural bodies approximated those predicted by these mathematical laws and mechanistic models, which were therefore intelligible, discoverable and useful for prediction. In the modelling process complex natural bodies, are considered - in a process of reduction - from a single viewpoint: the quantitative or mathematical. The natural physical body (what is the case), which cannot be fully comprehended in its multidimensional richness, is reduced to the relatively familiar and comprehensible point-object particle in motion (what seems to be the case). The driving force of mechanism with its accompanying use of efficient causality eventually led to the spectacular success enjoyed by the Industrial Revolution.

MECHANISM AS MATERIALISM

Mechanism becomes a metaphysics when the assumption is made that all phenomena, including natural bodies, are adequately explained by intrinsically immutable (i.e. subject to no intrinsic change) quantity and local motion, the basic characteristics of machines. This thinking finds its origins in the 'one and the many' debate between Parmenides and Heraclitus[1] in ancient Greece (Cavendish, 1985), seemingly resolved by Democritus who posited the existence of tiny indestructible material units (the one or being) called atoms and a void (non-being) allowing for plurality and motion (Torretti, 1999, p15). The atoms are therefore able to combine in various ways to form the changing macroscopic bodies of sense observation (the many). All phenomena, including natural bodies were then to be explained in terms of quantity and local motion. Whilst being derived from, although not fully defining, physical objects these models can be considered separately from the objects, although they can not require a separate existence simply by virtue of being intelligible.

Hobbes (1588-1679), whose long life spanned the modern origins of science, is considered the founder of modern metaphysical materialism (Flew, 1985). He equated the quantitative models with the whole of reality, ignoring the reductive process involved in their origin, and so created a metaphysics of mechanism. To identify models (eg. Newtonian particles) with natural bodies, or to regard them as equivalent, is to commit a category mistake of a type identified by Wittgenstein. Although they can appear in sentences of the same logical form, natural bodies and mathematical models do not enjoy the same form of existence.

Upon such a metaphysics, Hobbes developed an epistemology as well as natural, moral and civil philosophies which have continued to influence thinking to this day. Mechanism has become the common-sense method of understanding all physical phenomena. Furthermore, human systems such as politics and economics may also be thought to operate as machines with individuals mere cogs unable to determine their future.

Descartes (1596-1650), in his foundational search for the same absolute clarity and definiteness from the physical world as is found in mathematics, gained an apparently certain basis for knowledge from the existence of his mind which thinks (Watling, 1985). Distinguishing his mind or thinking self from his body, he placed the essence of bodies in their extension (composed of integral parts) with local motion as the only motion considered. This mind-body problem became a mind-matter problem when, as explained above, the abstract models were assumed to be existing physical entities, a process suited to the rationalist thinking of Descartes as it provided the desirable clear and simple ideas upon which a system of knowledge may be built. It was then an easy step for Hobbes to deny mind as a separate substance, and to make mind and matter equivalent. Mind then is considered to be fully explicable in terms of the mathematical models become physical particles, and motion.

MECHANISM AND AI

Such a conception of the human mind finds sympathy in contemporary attempts to construct artificial intelligence (AI) where some researchers "maintain that suitably programmed computers can literally be said to engage in processes of thought and reasoning" (Lowe, 2000, p193) thus emulating high-level functions of the rational human person. In AI, rather than the mathematical models of mechanics, the primary data are formal symbols embodied in an electronic memory device. Physical laws are replaced by the syntax of coded logical rules which manipulate the formal symbols under the power of a processing unit, according to the procedures built into these rules in order to simulate or model the computational processes of the human mind. In this understanding of AI (which is termed weak AI by Searle, 1990) the objectives include both development of more powerful mind-simulation programs and an improved understanding of the workings of the human mind.

The reductionist process of mechanism, again making a category mistake and identifying the model (here symbols and the processing unit) with the natural body (mind of the human person), leads to the claim (which is termed strong AI by Searle, 1990) that it will eventually be possible to create a mind, equivalent to a human mind, simply by designing a sufficiently complex computer program with the right inputs, logical procedures, and outputs. It is claimed that although "the human mind is complex, yet in principle it is equivalent to a finite automaton, which may be constructed from logical *nan's* (or *nor's*) and erasable bit memories" (Burks, 1990, p469). Popular publications contain claims such as "researchers from a variety of fields are.... predicting the creation of truly intelligent machines sometime this century" (Gallagher, 2000). It is not, then, a great leap from developing technology that imitates certain aspects of the functioning of the human brain, to concluding that the machine can think by virtue of implementing a computer program, and conversely that the human person is nothing but a machine, albeit a very complex one.

The Turing Test is designed to provide a scientific measure of the success of AI (producing conscious intelligence), by making a further reduction in assuming that if something behaves as if it had certain mental processes, then it must actually have those processes. However, the Turing test measures only the observable. Consciousness and knowing are not directly observable by others but remain a part of my experience. The very language used in the theory of AI and in this test suggests a certain equality of status for a computer system exhibiting certain types of behaviour (what appears to be the case) and the nature of the human person (what is the case). Further, the philosophy of logical mechanism holds, as a central thesis, that a finite deterministic automaton can perform all human functions (Burks, 1990, p409).

ETHICAL IMPLICATIONS OF MECHANISM

If the human person is fully explicable in terms of behaviour there is, according to behaviourist theory (eg., Skinner, 1973, chp 6), only caused behaviour which has remote causes in evolutionary history resulting in genetic endowment, and proximal causes in the feedback effect, known as operant conditioning, of the consequences of behaviour. These latter are the reinforcers or punishments, things which please or displease when experienced and which are thereby classified as good or bad as value judgements are made. Human life and behaviour are simply a continuation of the evolutionary process of successful adaptation to a changing environment. Positive reinforcers are such because they led to advantages in terms of species survival and are incorporated into species genetic make up.

Thus, there can be no objective basis for a theory of ethics that discovers the good to be done based on human dignity and purpose. From a mechanistic viewpoint there is no objective human dignity, just the appearance of it where the causes of altruistic behaviour are inconspicuous. The human person does not have an objective nature upon which appropriate behaviour may be judged, only an evolutionary history determined as the species adapts to the environment. Further, there is no need for ethics; desirable (adaptive) behaviour will follow deterministically when the consequences of behaviour are allowed to be experienced.

The only logical ethics to be applied is that of utilitarianism which makes minimal assumptions about the human person. This involves the maximisation of good (understood as pleasure) and the minimisation of harm (understood as pain) for the greatest number. Personal freedom can be exercised to the extent that no harm is done to anyone.

It should further be noted that ideas also have social consequences. If human persons are fully explicable in mechanistic terms, then they might justifiably be treated as objects (machines) to be used, or as means to ends. Just as items of computer technology may be readily replaced, without ethical concern, in the financial interests of shareholders, so also may workers be disposed of for similar reasons. Even a cursory acquaintance with contemporary social problems (eg. job losses and rural decline brought about by bank branch closures resulting from network communications) reveals that such scenarios are no longer simply theoretical.

CRITIQUE OF MECHANISM

There would seem to be convincing evidence that there is more to the explanation of natural bodies than can be provided by the mathematical models and abstractions of Newtonian Physics. Features of modern physics make a philosophical position that equates a natural body with its mathematical model less tenable. It can be argued that a position that equates mental processes such as reasoning with a computational model of reasoning is similarly lacking in justification. Computational models of mental processes (in terms of exactness of function and reflection) are no more real than the computational models of any other natural phenomena.

20TH CENTURY PHYSICS

The arbitrariness of the adoption of a mechanistic philosophy should be noted, since it has long been known that mechanistic theories, so successful in Newtonian physics are no longer compatible with many aspects of 20th century physics where many common sense understandings are found to be inadequate. Ordinary understandings of space and time are undermined (Theory of Relativity), indestructible and unchanging particles behave as waves obeying laws of chance in certain experiments (quantum physics), and the simple laws of Newtonian Physics often fail to explain the often capricious and haphazard behaviour of some natural systems (chaos theory).

HUMAN COGNITION

The central thesis of this paper is that there is an essential non-material aspect to human rationality. Natural bodies (things) are assumed to exist. The human person may find intelligible the essential nature of the thing by a process of abstracting (non-exhaustively, of course) from appearances (cf. Kretzmann & Stump, 1993, p142). The essential nature contains those features involved in a definition (eventually in terms of self-evident truths rather than involving an infinite regress) which cannot be changed without giving rise to a different kind of thing. The result of this abstraction is the concept or idea, which is separate from, but finds expression in words or speech. The possession of ideas is proposed as a pre-requisite for intelligence, and is what is meant by "knowing". Reasoning is then the process of drawing conclusions from propositions whose meaning is understood, because the idea corresponding to each word is possessed. In this process, a sequence of propositions are related according to the laws of logic, by means of cause and effect, or means-to-ends relationships.

COMPUTER COGNITION

That possessing ideas or knowing, the essential feature of human cognition and reasoning is lacking in computer cognition is well demonstrated by the Chinese room argument (Searle, 1990). This distinguishes mental contents biologically produced by the brain (semantics for Searle, or knowing ideas leading to meaning in the previous discussion) and the formal symbol manipulation done by a computer (syntax for Searle, or reasoning without knowing).

This argument considers a person with no understanding of the Chinese language alone in a room, possessing only a manual for relating one Chinese symbol to another (cf. a computer program), and receiving questions written in Chinese (input data) from outside the room. Using the manual, answers are composed by matching new symbols with symbols in the question, and then handed back to those outside the room (output), such that when the Turing test is applied, the answers provided are indistinguishable from those of a native Chinese speaker.

Yet, like the computer, the person in the room merely manipulates symbols to which no meaning (idea or knowing) is attached, before or after the exercise. Further, this person knows that she is merely manipulating symbols, without any understanding of the symbol sets. The symbol manipulation occurs without reference to any meanings, does not give access to the meaning of the symbols, and so does not involve cognition. Similarly, computer programs have syntax only, but no semantics; the mere manipulation of symbols is not equivalent to human reasoning since ideas and therefore knowing are absent.

If our interpreter were later to gain a mastery of the Chinese language and then re-visit the room, her experience would be entirely different, akin to switching on a light bulb in an unknown darkened room. She would now know the meanings of questions, and know that she now knows. Rather than the static answers of the manual, the answers to a given question might now vary over time as the interpreter's knowledge and experience grow.

HUMAN CONSCIOUSNESS AS SUBJECTIVE EXPERIENCE

The elusive concept of human consciousness has been described as the subjective character of experience (Nagel, 1974). For any organism, this is what it is for the organism to be that organism, the mental state or inner life of the organism. In the position taken in the paper, human consciousness would include the sum total of all knowing in terms of ideas possessed (however inadequate and awaiting further development) particularly in the context of the experience of knowing that one knows leading to awareness. One is also conscious (has knowledge) of other aspects of the inner life such as feelings and emotions.

To develop any model of consciousness (to elucidate understanding or build an objective theory), there must be a reduction from multiple viewpoints to a single viewpoint; some aspects must be left aside. However, there is only a single point of view in consciousness, the subjective character of the experience (what it is like for a bat to be, rather than to behave as, a bat, to use Nagel's analogy), and so any sort of reduction is not possible. The phenomenological features of experience or consciousness cannot be excluded in a reduction (as is usually the case in deriving models) because that is all there is to experience. An analysis in terms of functional and intentional states is not possible, because robots have these but since they do not know as we have defined knowing they do not experience states or events.

Ultimately, it is not possible to produce a physical theory of the mind (to be distinguished from physical processes in the brain). "If the facts of experience, facts about what it is like for the experiencing organism are accessible from only one point of view, then it is a mystery how the true character of experience could be revealed in the physical operation of the organism" (Nagel, 1974, p385). It follows then that it could not be possible, by electronic devices such as a robot, to produce or even emulate intelligent human consciousness, and so produce the fully functioning human person. That which cannot be modelled, cannot be symbolically represented in a computer program.

HUMAN AND COMPUTATIONAL REASONING

Electronic computers are ordered towards ends or goals, as these are set by a code writer listing instructions. AI technologies are essentially based on computers operating according to software instructions and are fully explicable as goal-directed, adaptive feedback systems which have:

- inputs (eg. present scenario for chess software, characteristic data for artificial neural nets (ANN), uncertainty estimates for fuzzy expert systems(ES)),
- deterministic processes (eg. rules of the game for chess, mathematical model for ANN's, inference rules for fuzzy logic) which lead to,
- an output to be compared with a predetermined goal (best move in chess game, output data to be matched in ANN's, conclusion best in accord with data for fuzzy ES) to give an error, and finally,
- Negative feedback which operates in an iterative step-by-step procedure to reduce the error by altering aspects of the process (point of search for chess, adjusting parameters in a "learning" process for ANN's) or aspects of the input data (fuzzy ES).

By definition, AI processes, as with other computer processes, do not step outside the well-defined step-by-step procedures of the programmer's code to think for themselves by understanding previously mentioned cause and effect or means-to-ends relationships.

Computer programs manipulate symbols (and the quantities they represent) according to procedures designed by the programmer who knows meaning and so possesses intelligence. The program may be perceived to behave as though it were intelligent, but only by virtue of the programmer who knows, and who must, therefore, as is widely acknowledged, accept responsibility for the performance of a particular device. The set of procedures embodied in executing instruction code may be perceived to involve reasoning, but again only by virtue of the reasoning powers of the programmer who knows the meaning of propositions, because she knows the meanings of the related concepts, and is able to construct the algorithm. This does not, of course, preclude the possibility of algorithms which might search for solutions under heuristic constraints, or discover proofs for theorems. Further possibilities such as program self-modification resulting from "learning" (eg. from an error calculation), or even program or computer reproduction may, again, only be present by virtue of the code.

ANN's imitate something of what is known of the cellular structure and physiology of the human brain. Stimulus (input) – response (desired outcome) training builds appropriate numerical values for weights and biases on mathematical models of neurons using training data. Purely mechanical explanations describe the predictive ("intelligent" or "learned") behaviour of the resulting mathematical expression. Rational activity of the human person cannot, therefore, be equated with the training environment of ANN's, or the programmed activity of Expert Systems.

Robots respond to stimuli from sensors according to a pre-arranged plan determined by the programmer and incorporated into a program code. The received sensor information is limited to material stimulation from the physical environment. Thus, such holistic and unquantifiable qualities as truth, beauty, harmony, proportion and brilliance which profoundly move the knowing human person when experienced in a work of great art, for example, will not be accessible to a robot.

Computers lack knowledge of relations, particularly those of cause-and-effect, as distinct from production rules, however complex, which are included in the coding for an Expert System. These latter are a function of the knowledge of relations possessed by the expert, acquired by the knowledge engineer, and coded by the system builder. A robot programmed or trained to return a certain tool will not look around for a suitable replacement when the tool is missing (unless, of course, specifically programmed to do so on a set of probabilistic usefulness functions). Even then the returned replacement will follow the programmer's code, rather than be the result of the robot's understanding of the function of the tool.

Computers lack human progress in the sense that they lack the property of self-awareness and reflection characteristic of human intelligence. This is to be seen as distinct from the ability to record (and so be trained by) and respond to past patterns of user behaviour. The computer is unable to reflect on its own performance, to know that it knows as does a human person. The computer, as already noted, can never step outside the code, reflect on the code, and contribute its own observations.

Computers may be programmed to make sounds imitative of a language in response to electronic stimuli, but lack speech since they lack concepts or ideas that find expression in words. Conversing can only mean making sounds without awareness of meaning. Thus, there is nothing possessed by the computer outside the program code (such as concepts or ideas), that corresponds to the sounds imitating human speech.

From intelligence in human persons there necessarily follows freedom of choice and the possibility of ethical life, but neither of these is found in computers. All choices are determined by the driving code, even if this code includes the generation of data from a probability distribution as in Monte-Carlo simulation. In simulation, a chance element is introduced into individual choices, but the over-all pattern of the probability distribution provides a deterministic outcome.

The absence of the possibility of their own ethical life means that electronic machines, or in fact any artefacts of technology, do not contain within themselves answers to questions about their possible ethical use, that is their use in such a way as to enhance the dignity of all human beings they are designed to serve. Instruction manuals explain how to operate computer systems, but answers to questions such as how, when, why and for what purpose various systems should be used may well be ethical questions with answers derivable from a values framework.

HOLISTIC CONCEPTION OF THE HUMAN PERSON

We propose an holistic and so non-reductionist (claiming to be what is the case) description of the human person as a basis for human ethics, from which flows essential human dignity as a basis for an objective human ethics. This description includes such exclusively human features we perceive in ourselves, all arguably arising from the uniquely human possibility of knowing, and knowing that we know, leading to consciousness, as the following:

- Rationality and desire for understanding and meaning, despite the acknowledged limitations imposed by unconscious psychological drives (cf. the work of Freud, Jung);
- Command of language enabling communication and exchange of ideas (thoughts), feelings, confidences, joys and happiness;
- Reflective consciousness or self-awareness; not only knowing, but knowing that we know;
- Subjectivity – a subject (thinker) as distinct from an object (which is thought about) or a thing;
- Incommunicable individuality;
- Creativity as found in the poet, writer, artist, often seemingly driven to create by a power greater than themselves;
- Possessing a centre of freedom whereby a person determines to choose (rather than is determined by) one motive among many, and so a particular course of action. Correlative to freedom is awareness of responsibility, the need to account for one's actions;
- Awareness of good to be done and evil to be avoided (cf the work of Kant drawing attention to the moral law within);
- Non-rational experiences such as emotions, desires, feelings, intuitions, dreams and images, premonitions, experience of synchronicity or meaningful coincidences which seem to be due to more than chance, including chance escapes from disaster, a mystical sense of awe at the complexity and beauty of all that is observed in the natural world, a sense of the sacred even in the ordinary, a sense of a spiritual character or soul;
- Bodiliness as a centre for relationships, sensuality and sexuality, distinguishing male and female, possessing privacy and dignity;
- Mortality as being subject to the certainty of death, but the subsequent anxiety being transcended by a desire for a higher life.

These aspects of the human person which, like the consciousness described above, defy mechanical or mathematical descriptions have traditionally been embodied in the concept of the soul.

ETHICAL IMPLICATIONS

These characteristics of the human person are the source of a special dignity. Like consciousness, described above, they cannot be reduced to an objective nature, using mathematical or other models. Conversely they cannot be reproduced using electronics to activate models embodied in computer programs. All this is arguably trivialised by mechanistic conceptions of the human person. The ethical critique should, therefore, identify the limitations of mechanism as a 'materialist philosophy which, whatever its value, is adopted or imposed by, but does not originate within computer science.

However, perhaps the most important source of human dignity, moral worth and title to respect arises from the responses we make to other persons and the way we matter to one another expressed as "love in its many genuine forms, ...from sexual love to the impartial love of saints" without which we would not have "a sense of the sacredness of individuals or of their inalienable rights or dignity...a sense that human beings are precious beyond reason or merit" (Gaita, 1999, p 5,8). We come to know, firstly and in a special way in those we love, an inestimable dignity beyond reason (when there may seem no source of dignity as in those with severe mental or other disabilities) or merit (where our love or trust has been seriously betrayed) possessing inalienable rights, being ends in themselves, and experiencing internal lives as rich in feelings, memories, thoughts and emotions as we find in ourselves. Respecting such dignity forms the objective basis for ethical treatment of others, made evident by the actions of those who love them, forms an objective basis for ethics.

CONCLUSION

Without, of course, questioning the value of AI for human welfare and progress, the paper has drawn attention to aspects of the discourse used in AI and some of its more controversial claims (particularly those of strong AI) which require understanding of their origin and an ethical critique. A philosophy of mechanism which makes the category mistake of giving the mathematical models of scientific mechanism the same sort of existence as natural bodies has been discussed. All reality, including human minds, are assumed to be explicable by material point objects exerting efficient causality of push-pull by virtue of their characteristic motion. If this is the basis of human rationality, the defining characteristic of the human person, then there is only human behaviour fully explicable in observable causes. This leaves no basis for "oughtness" in human behaviour; there is only that which pleases and that which displeases. There is no objective basis for an ethic of human behaviour, only a constantly adapting and evolving organism.

Ethics units in the IS curriculum are able to establish an objective basis for ethics a holistic understanding of the person replaces the reductionist models and the inestimable dignity of the human person is established and protected. The holistic basis, trivialised by mechanistic conceptions, arises from consciousness and this "like life itself and time and free-will, is one of the great mysteries before which we have to fall silent" (Townsend, 2000).

ENDNOTE

1. Each of whom performed reductions from the world of permanence and change in natural bodies (Heraclitus finding only measurable change, and Parmenides only the permanence of being) then equated all of reality with their partial viewpoints.

REFERENCES

Burks, A.W. (1990). The Philosophy of Logical Mechanism., in Salmon, M.H., (Ed.) *The Philosophy of Logical Mechanism.*, London: Kluwer Academic Publishers.

Carroll, W.E. (1999). *The Scientific Revolution and Contemporary Discourse on Faith and Reason.* Thomistic Institute, University of Notre Dame. (www.nd.edu/ Departments/Maritain)

Cavendish, A.P. (1985). Early Greek Philosophy. in O'Connor, D.J., *A Critical History of Western Philosophy*, NY, USA: Free Press, pp 1-13

Cornford, F.M. (1945). *The Republic of Plato.*, London: Oxford University Press.

Davies, P. & McGribbin, J. (1991). *The Matter Myth.* London: Harmondsworth, Penguin Books.

Flew, A.G.N. (1985). Hobbes., in O'Connor, D.J., (1985). *A Critical History of Western Philosophy.*. NY, USA: Free Press, pp 153-169.

Gaita, R. (1999). *A Common Humanity.*, Melbourne: Text Publishing.

Gallagher, J. (2000). The ethics of Intelligence., *PC Authority*, May: 129-136.

Grayling, A.C. (Ed.) (1999). *Philosophy 1.*, USA: Oxford University Press.

King, U. (1996). Spirit of Fire: The Life and Vision of Teilhard de Chardin, MaryKnoll, NY: Orbis Books.

Kretzmann, N. & Stump, E. (1993). *The Cambridge Companion to Aquinas.*, USA: Cambridge University Press.

Lowe, E.J. (2000). *An Introduction to the Philosophy of Mind*, UK: Cambridge University Press.

Nagel, T. (1974). What is it Like to Be A Bat? In Perry, J. & Bratman, M. (Eds), (1999). *Introduction to Philosophy, Classical and Contemporary Readings*, NY:Oxford University Press, pp 382-389.

Searle, J.R. (1990). Is the Brain's Mind A Computer Program? *Scientific American*, Jan :20-31.

Searle, J.R. (1980). Minds, Brains and Programs., in Perry, J. & Bratman, M. (Eds), (1999). *Introduction to Philosophy, Classical and Contemporary Readings*,. NY: Oxford University Press, pp 368-381.

Skinner, B.F. (1973). *Beyond Freedom and Dignity*, . Great Britain: Penguin Books.

Torretti, R. (1999). *The Philosophy of Physics.*, USA: Cambridge University Press.

Townsend, J.R. (2000). The Map of the Brain and the Mystery of Consciousness., *The Tablet*, Aug. 12, p1078.

Watling, J.L. (1985). Descartes, in O'Connor, D.J., (Ed.) *A Critical History of Western Philosophy*,. USA: Free Press, p 170-186.

INFORMATION TECHNOLOGY PARTNERSHIPS BETWEEN INDUSTRY AND ACADEMIA

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ABSTRACT

This paper describes the problems facing Information Systems educators in keeping current and producing graduates with skills that are valuable to employers. These problems are often magnified by rapid changes in technology. This paper proposes solutions to these problems through the creation of partnerships and learning alliances between industry and education. Several types of partnerships are described and reinforced with examples. These include: advisory committees, student internships, industry projects for college seniors, faculty internships/consulting, faculty/industry exchange programs, faculty training and updating, hardware/software resource sharing, mentoring, research grants and contracts.

INTRODUCTION

The many advancements in computer technology in the last few years, both hardware and software, have brought new challenges and opportunities to industry and academia alike. As most computer and information technology professionals are aware, the useful life of computer hardware was measured in years during the 1950s, '60s, and even into the '70s; but we now find new models of computers being introduced almost every month. Systems design methodologies and software development tools are also changing rapidly. "Because change is one of the few constants in technology, the business/academic connections must be revisited often"[1].

THE PROBLEMS

In an attempt to remain competitive, companies and organizations that rely on computers are being forced to continually upgrade their systems. This is not only costly, but in a period of time when the emphasis has been on corporate downsizing (right sizing), mergers, etc., it is extremely difficult to obtain and/or keep personnel who are knowledgeable in the use of the latest computer technology. For example, "We see a multitude of new job titles in this arena that did not exist ten years ago (e.g., database analysts, telecommunications/networking specialists, EDP security/auditing specialists, user support analysts, and office automation specialists)" [2].

In addition to the problems which are caused by the rapidly changing technology, the budgetary constraints under which many MIS Departments are working makes it very difficult, if not impossible, to provide the training needed to keep personnel up-to-date. On the other hand, it has long been considered the responsibility of our educational system to provide graduates with the background and skills necessary to be successful in their chosen fields of employment. For that reason, when employers do recruit graduates, they look to colleges and universities with a curriculum that utilizes new technology and emphasizes current practices [3]. Because of the rapidity in which technological changes are taking place, computer educators are finding many obstacles to fulfilling this responsibility. These obstacles include limited budgets, lengthy curriculum review cycles, obsolescence of hardware, software, proliferation of new course topics, obsolescence of faculty skills, and the difficulty of recruiting qualified faculty. These obstacles are further magnified when you consider the ever changing demands of industry. Historically, the degree requirements that were in effect at the time a student entered college are the same requirements that must be met four, five, or even more years later when the student is ready to graduate. Although this policy was initially designed to protect students who might never graduate due to ever changing requirements, it also means that students who are majoring in a technology-oriented discipline may be graduating with skills that are obsolete by the time they complete the stated requirements for graduation.

Another major problem faced by colleges and universities is a problem similar to that faced by industry: keeping instructors up-to-date and qualified to teach students how to use the latest computer hardware and software. Even if instructors do find ways to keep current personally and then attempt to modify course content to include the use of new technology, they often find it necessary to develop their own teaching materials because there are no up-to-date instructional materials.

Based on the experience of the author, the problem most frequently mentioned by educators and students is the lack of hardware and software representing the latest technology. Some academic institutions are attempting to solve this problem by requiring students to provide their own personal computers and related software. This results in a shift of the budgetary problem from the institution to the student and, at best, is only a temporary solution because the institution is obliged to, but doesn't always, provide appropriate hardware and software to the faculty for research and course development.

So far, numerous problems have been identified, but few solutions have been offered. In fact, the author believes that the above problems will only become worse if educational institutions and industries do not work together to solve these problems. Organizations need employees who are skilled in the use of the latest computer technology, but they don't have the time or trainers to complete the training. Academic institutions, on the other hand, have faculty with the expertise to provide the training needed by industry, but are unable to acquire the latest versions of hardware and software. "Some researchers have concluded that businesses and universities share some similar challenges, and increased cooperation between the two entities will assist in shared solutions for both" [4,5]. The author believes that the key word is "cooperation." By combining their resources and partnering together, many of the problems and shortcomings faced by each can be alleviated. Based on my experience, it is time for universities to join forces with industry and use creative partnerships to the fullest. This paper discusses how.

PARTNERSHIPS TO EXPLORE

An important way in which corporations may invest in the future is by funding university research and development efforts in technology - related efforts. Donations by corporations may be in the form of money, computer hardware/software, donated and paid employee time, efforts, skills and training. Nine ways in which partnerships can be formed are summarized in Table 1 and discussed and illustrated with examples in the following sections of this paper.

TABLE 1
PARTNERSHIP OPPORTUNITIES BETWEEN INDUSTRY AND ACADEMIA

1. Advisory Committees
2. Student Internships
3. Industry Projects for College Seniors
4. Faculty Internships/Consulting
5. Faculty/Industry Exchange Programs
6. Faculty Training and Updating
7. Hardware/Software Resource Sharing
8. Mentoring
9. Research Grants and Contracts

Advisory Committees

A problem that is of particular concern to CIS/MIS educators is that of attempting to keep the curriculum up-to-date. Which software packages, programming languages, systems methodologies, and case tools should be taught and/or utilized? What hardware should be used? More often than not, there is no single answer to these questions. Each campus must determine the needs of the community it serves. That is, what are the needs of the major recruiters or companies in the area? The intent here is to identify the needs of companies collectively and not individually. A campus can't be all things to all people.

Rather than work in a vacuum, universities should determine what computer hardware, software, and applications are being used in the organizations which hire their graduates. An excellent way to accomplish this is through the formation of an advisory committee which is made up of alumni, MIS Managers, and recruiters. The individuals selected should be in a position to know the needs of their organizations, as well as having a feel for the direction that the computer industry is moving. Traditionally, alumni of the program and managers who have hired graduates of the IS program are in a position to provide input regarding the relevancy of the content of individual courses and the curriculum as a whole.

It is recommended that this advisory committee meet as a body at least once each year. Preferably, the meeting would be scheduled one or two months before the deadline for submitting curriculum change proposals. The agenda for each meeting should include a report on hardware and software in use or on order by the university, curriculum changes being considered, and any problems since the last meeting of the committee. Faculty requests for resources and curriculum changes that have been recommended or supported by an industry advisory committee are usually looked upon more favorably by the campus administration than those submitted by departments that do not utilize advisory committees. In addition, it has been the author's experience that organizations that have an employee on an advisory committee are much more likely to enter into some form of "partnership" with the university. An advisory committee could be structured as an affiliates program or friends of the department where members pay a fee to belong (e.g. UCLA affiliates). A word of caution, members of an advisory committee must understand and accept the fact that they are advisory only and not in a position to dictate curriculum and/or practices to the university.

Example: California State Polytechnic University, Pomona invites industry input. Although not referred to as an advisory committee, California State Polytechnic University, Pomona (Cal Poly, Pomona), utilizes input from industry in its decision process as it relates to curriculum and course content. The faculty of the CIS Department at Cal Poly, Pomona traditionally hosts a luncheon for industry "friends of the department" approximately once each quarter. About 20 corporate recruiters, MIS managers, and key alumni are invited to these luncheons with different industry representatives being invited each quarter. The faculty of the CIS Department make a short presentation after lunch to describe what has been accomplished during the past year, problems that have been encountered, and changes (to hardware, software, and curriculum) that are being considered. Each attendee is then given the opportunity to describe changes in MIS being considered and/or implemented by his/her organization and to provide comments, both positive and negative, about the changes being considered by the department. The input from the corporate representatives has proven to be extremely valuable in the final decision process at Cal Poly, Pomona.

Example: PeopleSoft establishes alumni outreach program and academic advisory council. An emerging model of partnerships is heavy involvement of alumni who work in industry to help with the recruitment of new graduates. PeopleSoft, a software company based in Pleasanton, CA, is successful at recruiting large numbers of technical personnel through alumni. The firm usually targets its recruiting efforts at about 10 universities annually, for example, Carnegie Melon, Cal Tech (Pasadena), Howard and Tuskegee Universities. The alumni of these schools who are team leaders make frequent visits to these campuses over the course of a year. Occasionally informational speeches are made to technology students to inform and attract them to PeopleSoft.

The "PeopleSoft on Campus" initiative is geared toward integration of PeopleSoft software training into the curricula of colleges. Developed by PeopleSoft's Academic Advisory Council to meet needs of the academic community, the program centers on how the business world utilizes PeopleSoft. Beginning in 1999, PeopleSoft Human Resource Management and Financial Software (HRMS) has been distributed free of charge to Universities for students to experience first hand. As part of this pilot program, PeopleSoft representatives came directly to Cal State, Hayward in support of this program. It is appropriate to comment here that the role of the PeopleSoft Academic Advisory Council has more of a corporate orientation than most advisory boards for universities.

Student Internships

The term internship is used to describe all programs where students work part-time in a position related to their chosen career field while continuing to make progress toward their degree objective. Student internships are not new, but they are often not utilized by industry. The question might be, why aren't student internships used more by businesses considering the many benefits that can be derived? Some of the benefits to the employing agency are: (1) a ready source of "skilled" applicants, (2) an opportunity to test employees without a long-term commitment, (3) a relatively inexpensive source of labor, (4) highly motivated employees, and in some cases, (5) applicants who have been "prescreened" by the university. According to a

1994 New York Times article, "Employers nationwide are hiring four of every five of their college interns full-time after graduation" [6].

The benefits are not limited to employers. Internships also provide benefits to the university. An internship provides (1) a real world test of the academic program, (2) a supplement to classroom learning, (3) access by the student to expensive resources, (4) a ready market for the product (graduate) of the university, and (5) a motivated student because classroom learning becomes more relevant.

Example: California State Polytechnic University, Pomona has a well-established internship program with approximately 65-70 students receiving academic credit for their work experience each quarter. Because some organizations may have a policy (sometimes union controlled) against hiring part-time employees, Cal Poly, Pomona has established contracts to provide "temporary MIS employees" with two major organizations. The most successful program has been in existence with the County of Los Angeles for over ten years. In that situation, the university fills temporary positions with qualified students and, in turn, bills the County for the students' services. A pay scale has been agreed upon as part of the contract whereby the pay is different for lower-division, upper-division, and graduate students. In fact, the contract also specifies an hourly wage for faculty consultants. The agreed upon pay scale includes an "administrative charge" for administering the payroll function for the contract employees [7].

Industry Projects for College Seniors

Complex subjects are learned best by students if the students are involved in a variety of different teaching methods. Students can read about the subject, observe demonstrations, listen to lectures by an instructor, or be actively involved in the learning process through the assignment of a project or case study. Students usually learn best by physically doing something. In this case, the more realistic the project or case study assignment is, the more valuable the learning.

Since most companies have a backlog of systems and programming projects, it would seem quite likely that one or more of those projects could provide a valuable learning experience to students. A key consideration in selecting real projects from industry is that the projects must: (1) fit the timeline of the term, either 10 or 16 weeks, (2) have a required deliverable at the completion of the project, and (3) provide a learning experience consistent with the learning objectives of the course and curriculum.

Real-life senior projects from industry provide a good introduction to the problems that will be faced after graduation. Of particular value is the students' realization that communication skills are important if they must work in a team environment and meet periodically with the industry liaison. The university benefits inasmuch as many of the projects involve hardware and/or software that is not available at the institution. The cooperating organization gains by having a low priority project completed at virtually no cost. Based on the experience of the author, companies that do end up implementing the student-developed results are often quite willing to make a contribution (hardware, software or money) to the university.

Example: California State University, Hayward arranged for a team of seniors in CIS to work on a database design project for Oracle Corporation. After graduation the students were offered employment--evidence of a mutually beneficial arrangement. Subsequently, Oracle donated software to the University for use in student labs.

Example: California State Polytechnic University, Pomona utilizes real-life projects in its capstone course for all CIS majors, CIS 466 Systems Development Project. Student teams of 4-5 students are assigned to each project which culminates with a formal written and oral presentation (defense) of the project solution to the management group which provided the project.

Faculty Internships/Consulting

Faculty internships, unlike student internships, usually involve full-time employment during the summer. In some instances, a faculty internship could require the faculty member to take an unpaid leave of absence from teaching for one or more terms. Regardless of the duration of the internship, the employer and university both enjoy benefits from the program. The employer gains from the expertise of the faculty member, while the faculty member gains insight into the use and application of some of the latest computer technology.

Example: IBM occasionally hires a college professor on unpaid or sabbatical leave. IBM also participates in employee exchanges that include University faculty as well as IBM employees. For example, IBM formed a cooperative program with the University of North Carolina at Chapel Hill to educate faculty from around the United States to learn new research and instructional uses of computer technology. The main purpose of this program is to integrate technology into the curriculum by using computer equipment and packaged software.

Faculty/Industry Exchange Programs

A few large corporations, such as International Business Machines, have been involved in faculty/ industry exchange programs for many years. In this program, a faculty member is assigned to work for the cooperating organization while an employee of that organization is scheduled to work at the university. That work might consist of teaching courses, assisting in new course development, and/or training other faculty in the use new hardware or software. These exchanges are usually of a short duration, usually one year or less, and the salary and fringe benefits of the people involved are maintained by the original employing agency.

Example: IBM has a faculty loan program. The faculty loan program is an agreement between senior IBM employees specifically located in North America and the university of the employee's choice. A maximum of 7 employees per year of some 200,000 in North America are selected to participate in this program. Once an employee is selected, s/he is placed in a "leave status" from their current position within IBM to become an acting university faculty member at an American University.

Typically the recipient Universities are delighted to obtain a "free" professor for any amount of time. Part of this time is used to plan for these programs by IBM and the participating universities before the partnership agreement is complete. The legally binding one-page Document of Understanding (DOU) is prepared to avoid any legal problems. The appointment is arranged initially for one year but can be extended up to a three-year term. The employee assumes the role of faculty member in his/her area of expertise in the appropriate department of the university.

Participating universities do not compensate the acting professor and are not obligated to IBM through any financial, personnel, or informational exchanges. The employee remains on the IBM payroll and is reimbursed for all expenses related to the assignment to the university. IBM management perceives the costs incurred as a long-term investment in the technological education of US students. Upon completion of the assignment, the employee may return to the past position at IBM or venture into a vacancy at his/her management level. Sometimes the employee may opt to retire from IBM and join the University faculty for an extended period of time if not permanently.

Faculty Training/Updating

One of the problems faced by both businesses and academic institutions is that of attempting to keep personnel up-to-date with the latest technology. Most large organizations attempt to overcome this problem by providing training for their employees. In many instances, this involves paying all expenses to send one or more employees to another training site for a few days--in some cases one or more weeks. This is extremely expensive if many employees must be provided with the same training. In those cases, organizations often hire a professional trainer and hold the training sessions at the local place of business. When this is done, the cost of the training is usually a fixed amount regardless of the number of individuals being trained. Therefore, it costs the company nothing to invite one or two faculty from the local university to attend the training session. The only cost to the university is that of providing a substitute teacher for the classes missed and, in many CIS/MIS Departments, the missed classes are taught as an overload by other faculty in the department as is traditionally done at Cal Poly, Pomona.

Hardware/Software Resource Sharing

In the past, many companies have donated computer equipment that they no longer need to academic institutions. Although this is still a possibility, there is a high probability that any equipment being offered as a donation is already obsolete and will not be of any major benefit to an academic institution either. Another way in which access to needed hardware/software can be provided to universities by industries is via networks. Since most companies are now using networks to communicate with different entities within their organization, the CIS/MIS Department at the university can be established as a node on the company's network. It may be necessary to limit access by the university to certain hours of the day so that the ongoing operation of the company is not impacted. In addition, care must be taken by the company to assure that access is controlled and limited to only those areas previously agreed upon. With proper controls, valuable resources can be shared with an academic institution with virtually no extra cost to the company.

Some much needed software cannot be obtained by universities because of the high cost of licensing. On the other hand, it is quite possible that a local company may have a licensing arrangement that provides more copies of software than that company actually needs. For example, a company that needs 30 copies of a software package may find that the cost is the same for 25-50 copies. Some of the excess copies, with permission of the software company, can be "loaned" to the university. In the long run, the company benefits because graduates will be trained on the software that companies are using.

As noted above, the sharing of software or use of software licensed to another person or entity should only be done with the written permission of the software vendor. Based on the author's experience, such permission can usually be obtained if the software vendor is involved early in the decision process and knows how and where the software will be utilized in the curriculum.

Example: Microsoft software donations. Of the 3.4 million estimated technology jobs nationwide, 10% are vacant, thereby slowing the growth of technology-based industries. (Virginia Tech University Study, 1998). By donating software to high schools and colleges, Microsoft hopes to persuade students to select a technical professional career and eventually relieve the shortage of technically qualified workers. Furthermore, investing in development of future technical professionals is consistent with the Microsoft goal of retaining 90% market share.

Microsoft launched a software donation project to benefit middle schools, high schools, vocational and technical schools, and universities that specialize in computer science and technology training. In 1998 recipient schools were given over 18,000 software licenses, Microsoft Visual Development tools and operating systems. Software licenses were for Visual Basic, Java Professional Edition, Visual InterDev Web development, Office 97 Developer Edition, and Windows, or NT operating systems. Through these software donations Microsoft helps to provide practical solutions to complex challenges facing high schools, and especially college and university computer science, engineering and information systems departments attempting to integrate new technology into their curriculum. A web site was prepared to assist faculty in the integration of these tools into the curriculum (www.microsoft.com).

Example: Intel partnerships. Intel began a three-year partnership grant program called Education 2000 for the advancement of information technology research and development and curriculum development. To win a grant, universities must demonstrate academic excellence, commitment of the university to support the grant objectives, and the potential benefit to students and faculty. Intel takes the initiative by sending a team of people to the universities identified, interviews the faculty, and determines what the needs are and how best to help the university. The donated equipment helps to keep the university computing facilities on the leading edge of technology. The main disciplines to benefit from the Intel grants so far are computer science and engineering. Additional disciplines that may become eligible include anthropology, astrophysics, medicine, biotechnology, business, public policy, journalism and the arts. Grants are made in the form of high-speed multi-media computers, workstations, servers, and networking hardware and software.

Not only is software donated, but funding is provided for various projects such as developing next generation, content based networked multi-media technology for "digital storytelling." Recipients have the option of also working on specific needs for their schools. For example, Columbia University, has opted to upgrade all digital operations. As a direct result of an Intel grant, Columbia upgraded the entire infrastructure of its journalism school which conducts collaborative research with the engineering school by using Intel equipment to investigate multi-media searching and storytelling applications.

Intel and other companies with similar programs often find it easier to work with schools and departments that have established industrial relations departments to interface with industry (www.Intel.com).

Schools located in geographic proximity to Intel and other large companies stand to benefit from partnerships also. By seeking to improve the curriculum, computing, and software environment of local schools, these multinational corporations hope ultimately to hire local graduates, which saves the firm relocation expenses upon hiring.

Mentoring

Mentoring programs usually focus on attracting a diversity of students to technical majors such as engineering, computer science, information systems and the sciences. Either a representative from industry, a faculty member or graduate student will team up with and assist female and minority students in particular who may have difficulty with prerequisite subjects such as math. Successful mentoring programs lead to the selection of technical majors by these students and facilitate their successful completion and eventual employment. The company that sponsors the mentor benefits by increasing the pool of potential employees and the individual student benefits by enhancing their employability through improved education.

Example: Motorola establishes mentorship programs. Business models have evolved over the past several years to incorporate faculty and university administrators into the "learning leadership team model and initiative" headed by Motorola, beginning in 1992. The main focus of these models is for faculty to understand that all changes in reference to technology education must be systematic, with a team to support this change and that a student-focused approach must be used to determine the specific areas for future change. Northeastern Illinois University has been the academic leader for these partnerships, including the Minority Mentorship Program, which matched incoming freshmen with faculty who help to build a personal support relationship. www.motorola.com)

Example: Hewlett Packard partners to mentor women, minorities. Hewlett Packard has been a pioneer in a variety of partnerships to further educational enhancement within the technology arena. In 1997 HP announced a partnership to broaden opportunities for women and minorities in the engineering, computer science and related technical fields. Called "Diversity in Education Initiative," HP entered into partnerships with various universities and school districts to focus on K through 12 levels of education. This program provides monetary gifts to universities that work together to prepare females and minorities for college level math and science courses as a foundation for pursuing engineering and computer science majors in college. This program targets majors where women and minorities are under represented, due to difficulties in math and science. HP provides scholarships to high school and college students and provides job opportunities for them while attending school. These support systems are provided to increase the graduation and employment rates of women and minorities specifically. HP management felt that this extra effort of philanthropy would spark interest among other organizations to follow suit.

Participants involved in this program are the University of California, Los Angeles with the Los Angeles Unified School District, San Jose State University, working with Alum Rock Elementary School and East Side Union High School Districts, Northeastern University, Boston with Boston Public School district, Lower Roxbury area, and the University of Texas at El Paso with the El Paso Independent School District. These universities collaborate with each other to work with several high schools, middle schools and elementary schools.

All participating Universities are on a five-year plan to implement math and science enrichment and mentoring programs for high-school students to increase retention rates of female and minority students with a specific focus on preparing for computer science. A total of $125,000 has been received for each of the five years; each school annually receives $25,000 to support these initiatives. Partners within the K-12 areas receive $290,000 each to carry out math and science programs on each grade level. Engineering and Computer Science students have the opportunity to apply for $3000 scholarships provided by HP to each of the university partners for this project.

The ultimate goal is to alleviate the statistics that women and minorities drop out of engineering and computer science majors more often than Caucasian males. Hewlett Packard hopes to increase the mathematical skills so that these students are well prepared to enter into technology specific industries and compete well in college. HP has also encouraged universities and other corporations to offer technical classes for students.

In 1996 Hewlett Packard continued its support for these and related programs by donating over $40 million in cash and products to improve the quality of education from kindergarten to the university level. The University of Washington and the California State University System are among the many beneficiaries of Hewlett Packard donations (www.hp.com).

Research Grants and Contracts

Many corporations see funding university research and development efforts in the area of technology and science as a valuable way to invest in the future. Donations may be in the form of money, computer hardware/software, or even employee time. Relationships with industry have eased the financial burden of many universities which in the past were not able to conduct intense research due to the limited availability of government funding. University research has become increasingly dependent on corporate donations. Corporations have created and opened the window for outreach and technical growth while in conjunction these donations provide students with the chance to continue their knowledge with hands-on experience using current technology in industry. Universities are building opportunities for faculty and staff that will provide the knowledge needed to help students quickly acclimate into the work force with computer literacy, knowledge about software applications, programming and operating systems. The corporations benefit by gaining access to the best students for potential hire and to innovations that lead to new products. Thus, collaboration between faculty, principal investigators, national laboratories, non-profit research centers and industry researchers can be mutually beneficial.

Example: Sun Microsystems facilitates collaborative research. Sun Microsystems, located in the Silicon Valley of California, has been actively involved in the educational community specific to technology. Collaborating with faculty, research directors and principal investigators at universities, national laboratories and nonprofit research organizations, Sun's presence is very large in this geographical area. Consistent interest and interaction with these organizations through collaborative efforts have helped to enhance the success and future of Sun. All projects that Sun participates in have the common mission, "Future technology having commercial importance within the next two to five years ultimately providing direction for engineers and management at Sun" (www.sun.com/products-n-solutions.edu).

Sun has founded the program and created provisions for easy accessibility for new projects. Graduate level or undergraduate level students may simply discuss partnership ideas with faculty advisors, who in turn communicate these ideas to Sun. The mission of Sun collaborative research is to recruit and hire the best students, encourage and promote faculty research and sabbaticals, student internships, transform university research into new Sun products, and to create future trends in computer and information technology. The initiative owner, along with the Sun Technical Sponsor, oversees the implementation of the particular project (www.sun.com/products-n-solutions/edu).

Example: Apple Computer partners with Carnegie Mellon. Apple Computer joined forces with Carnegie Mellon University in a collective effort of resources to build a Mac II version of Mach, a multiprocessor operating system. Over a two-year period of production, the final product, Mac IIs, is available to run Project Andrew application. Project Andrew is a wide area network that allows users to run applications on the networks of other machines (www.apple.com).

STANFORD UNIVERSITY: PARTNERSHIP PIONEER

Stanford University, known for bridging and building many technologically based partnerships with corporations globally, reported that in 1998 the University was actively involved with 20 corporate partners. With the consistent donations of these corporations, Stanford has been able to explore and expand core research, enhance outreach capabilities, and enter into new collaborative research projects. These partnerships have enhanced the curricula of several Stanford schools and departments and have increased awareness of the importance of information technology and input from public policy makers on technology-specific topics (www.stanford.edu/group/scip/).

Stanford computer industry project for software research. Using the funding received from many of its partners, Stanford University has entered into a strategic research project specific to software. Another venture resulted in Stanford conducting research about segmentation in the software industry. The focus of this study, conducted under the auspices of the Sloan Foundation, is current patent law, piracy, trade policy, labor, immigration, education, antitrust, international competition, quality and technology change (www.-scip.stanford.edu/scip/).

Strategic uses of information technology project (SUIT) facilitated by education forum. Stanford created an educational forum in 1996 geared toward senior level executives to meet and discuss technology needs of the business world. After much success in the first forum, the project was incorporated into the

Stanford graduate-level executive education program. Various portions of this project have been presented and well-received at conferences around the world. Thus, the educational forum assumed the role of an advisory board to help Stanford get started with SUIT (www.stanford.edu/group/scip/).

SUMMARY

The above suggestions are only some of the ways in which organizations and universities can partner to overcome some of their problems and achieve their objectives. It should be noted that the benefits that can be attained far exceed any costs that may be involved in the implementation of these suggestions. Many of the suggested areas for partnerships presented in this paper have been proven effective at universities where the author has taught. The author is of the opinion that all of the suggestions for partnership ventures could work to some degree for all colleges and universities.

REFERENCES

1. Heiat, Heiat, and Spicer (1995), "Future Software Training Needs: Contrast in Needs as Perceived by Business and Academia", *Journal of Information Systems Education*, Fall, 1995, pp. 102.
2. Mawhinney, Charles C., Joseph S. Morrell, and Gerald J. Morris (1994), "The Undergraduate Curriculum: Closing the Gap", *ISECON '94 Conference Proceedings*, Park Ridge, IL.: Data Processing Management Association, 1994, pp. 249-253.
3. Davis, L. (1989), "Can Education Meet IS Career Demands?", *Datamation*, March 15, 1989, pp. 65-69.
4. Wright, Phillip C. "The CEO and the Business School: Potential for Increased Cooperation?", *Journal of Education for Business*, September/October, 1992, pp. 32-37.
5. Christensen, Ann L. and Donna Philbrick (1992), "Business and Universities: Similar Challenges, Shared Solutions", *Journal of Education for Business*, September/October, 1992, pp. 6-10.
6. Lum, Lydia, (1994, New York Times Service), "Firms Hiring 4 Out of 5 of Their Interns", *Inland Valley Daily Bulletin*, January 30, 1994, pp. A 13.
7. Wagner, Gerald (1995), "Internships: A Bridge Between Theory and Practice", *ISECON'95 Conference Proceedings*, Park Ridge, IL.: Data Processing Management Association, 1995.

Note:. Regarding web sites consulted (Microsoft.com, Intel.com, Motorola.com, Hp.com, Sun.com, Stanford.edu), contact author for hardcopy backup obtained during July 1999.

CONTEXTUAL DIFFERENCES BETWEEN EDUCATION AND TRAINING IN MIS CURRICULUM DEVELOPMENT

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PANEL PROPOSAL

This panel will explore the differences between education and training in the context of MIS curriculum development. The discussion will consist of examining the relevant premises for comparison and the need to understand the pedagogical differences. Relevant premises are based on various research studies (Cohen & Lippert, 2000; Lippert, Granger, & Lydon, 1999; Lippert & Granger, 1998) coupled with panelists' experiences, observations, working papers (Cohen & Lippert, 1999b), published manuscripts (Lippert, 2000; Cohen & Lippert, 1999a), and presentations (Cohen & Lippert, 1998a, 1998b).

A role of academic MIS educators is to provide a broad theoretical foundation grounded in MIS principles and procedures for aspiring technology and business professionals. Education, operationalized as, the gradual process of acquiring awareness through instruction and activities which enlighten and impart knowledge, furnishes this theoretical foundation for life-long learning. Education provides breadth and scope of instruction with high levels of generalizability to similar situations.

In a field of study, where change is constant and technologies frequently modify, both internal and external pressures may challenge MIS educators to offer instruction on the utilization and manipulation of the latest technologies. This instructional approach where instruction is specialized and aimed at skill transference and applicability to a specific task or technology is operationalized as training. A goal of technological training is proficiency at performing a specific task.

Theoretical, practical, and pragmatic differences exist between education and training in terms of admission criteria, purpose of instruction, learning objectives, instructional procedures, scope of instruction, instruction timeframe differences, delivery methods utilized, instructor knowledge and experience based on terminal degree status, and expected outcomes.

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Contextual differences between training and education exist with respect to business decision-making processes. Training addresses fixing the problem where education addresses diagnosing the problem. The desired end state is technological usability relevant to managers in their business decision-making process.

Part of the student's educational experience is interest cultivation in exploring and answering unanswered questions. In addition, part of the educational process is to teach students how to think and how to deduce relevant facts from previous learning. Training is instruction presented with emphasis placed on accomplishing the instantiation of the task and may not offer the needed basis for future growth and intellectual connections.

Yet, the often-expressed polarity between these two learning approaches may foster an either/or mindset possibly excluding integrated instructional strategies. MIS curriculum alternatives spanning the polarity divide include:

- A theory based course devoid of hands-on laboratory instruction
- A skills development course or
- A unified bi-component course comprised of a theory-based element coupled with an integrated hands-on laboratory component.

However, from an educational perspective, a blending of theory and the hands-on experience may offer students theoretical grounding and practical application within a guided learning environment. For example, educators may develop real world exercises with Oracle's Designer 2000 for data modeling or Developer 2000 to provide hands-on experience with database concepts. Novell 5 may be used to reinforce Network Operating Systems concepts. If students can be 'educated' while being partially trained on 'hot' technologies, shouldn't we as educators be doing so?

ACM curricula recommendations offered as the IS'97 Model Curriculum advocate that all Information Systems students possess computer literacy in skills usage and application (Davis, et al., 1997, 9). The skills prerequisite is typically acquired before formal courses. The six types of applications (Internet and electronic mail, spreadsheet processing, database management, presentation graphics, statistical analysis, and external database retrieval) form the competency base for all IS students (Davis, et al., 1997, 10). IS'2000 (http://cis.bentley.edu/isa/pages/ is2000.html) is the update of IS'97.

These contextual differences between training and education in MIS curriculum development are further illustrated when

- The issue of course credit is discussed
- The potential absence of theoretical underpinnings related to specific package usage is considered
- The importance of marketable stills obtained by graduates is stressed
- Different student learning expectations are evaluated
- Different student interests are contemplated and
- The increasingly diverse skill ranges of student abilities entering the university are addressed.

Intellectual exchange stimulated through an environment of open discussion is proposed for this panel presentation.

REFERENCES

Cohen, D.J. and Lippert, S.K. (2000) Technology and Today's Workers. *The International Federation of Training and Development 2000 World Conference and Exhibition*, London, England, April.

Cohen, D.J. and Lippert, S.K. (1999a) The Lure of Technology: Panacea or Pariah?, *Journal of Management Education, Special Issue on Innovative Uses of Technology in Management Education*, (23:6), December, pp. 743-746.

Cohen, D.J. and Lippert, S.K. (1999b) Training Methods: An Integrative Look at Instructional Choices for the New Millennium, Working Paper, George Washington University.

Cohen, D.J. and Lippert, S.K. (1998a) Individual, Situational, And Organizational Factors, Characteristics, And Perceptions Impacting Training Programs and Training Outcomes: A Conceptual Model and Discussion. *The Academy of Management Annual Meeting*, San Diego, California, August, 1998.

Cohen, D.J. and Lippert, S.K. (1998b) Old Technologies Versus New Technologies: A Look At Instructional Choices for Individual Development. *The International Federation of Training and Development Organizations Conference*, Dublin, Ireland, July, 1998.

Davis, G.B., Gorgone, J.T., Couger, J.D., Feinstein, D.L., and Longenecker, H.E. (1997) IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. *Association of Information Technology Professionals.*

IS '2000 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. Available, [online], http://cis.bentley.edu/isa/pages/is2000.html.

Lippert, S.K. (2000) Incorporating Knowledge into the 21st Century Training Process, *IHRIM.Link* (V:1), February/March, pp. 28-29.

Lippert, S.K., Granger, M.J. and Lydon, S.R. (1999) Supplementing Traditional Instructor-Led Instruction with Computer-Based Instruction in an Introductory Information Systems Course, in *Proceedings of the 1999 Information Resources Management Association International Conference*, M. Khosrowpour, (ed.), Hershey, PA, May 16-19, pp. 343-349.

Lippert, S. K. and Granger, M.J. (1998) "Tired of Teaching Software Application Packages?," in *Proceedings of the 13th Annual International Academy for Information Management Conference*, C. Rogers (ed.), Helsinki, Finland, December 11-13, pp. 22-30.

FACT OR FICTION: ENTRY-LEVEL COLLEGE STUDENTS ARE READY FOR AN ADVANCED COMPUTER APPLICATIONS COURSE

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Extended Abstract

It is generally accepted that change is the only constant. If that is correct, it should be anticipated that students entering a university-level introductory computer course bring different computer experiences today than previously. That was the premise which prompted a change in core requirements for most School of Business majors at this university. Students are now required to complete an advanced microcomputer course rather than the beginning course. This study was undertaken to assess the computer skills of students entering the introductory course at this university. Do our students possess improved and broadened computer skills in the use of the software applications being taught in the introductory course? Are most students are ready for an advanced microcomputer applications class rather than the introductory class? The project is ongoing; however, this paper discusses the study and preliminary results.

BACKGROUND

The introductory level computer applications course has, at many universities, undergone a series of changes during the past 10-15 years. At the university in which this study was conducted, those changes have been, primarily, technology driven. This study was undertaken to determine whether those changes, and consequently the current course content, meet student needs.

Though initially a class taught solely by an instructor, for several years the introductory computer course at this university has been taught via computer-aided instruction (CAI) with minimal faculty oversight. In the last two or three years, this course has also been taught as a distance education course.

Technology has driven not only the method of delivery for the introductory computer course but also the course content. It has catapulted the course through programming, DOS, Windows, and various software applications. In a very short time span, application packages increased in capability and complexity, and advanced from DOS- to Windows-based, with an accompanying increase in time needed to adequately cover a fair number of components. The software applications taught in the introductory course also changed with technology as integrated packages were touted as advantageous and as Bill Gates' marketing strategy to bundle software and hardware took its toll in the market and in the classroom.

RATIONAL

The content of a university course should be a function of at least two considerations: employer expectations upon graduation and student preparedness at entry. Other probable considerations include facilities, equipment, teaching staff, accreditation standards, and additional course offerings. The introductory computer applications course at this university has evolved from a course for CIS majors through a course for all business majors into a university service course. The course content is now an introduction to Windows, word processing, spreadsheet, database, and presentation software. It is also the prerequisite for the advanced microcomputer applications course.

Recent curriculum changes in our School of Business sparked much discussion about the introductory-level computer course vs. the advanced microcomputer applications course, the content of each course, their purposes, and their placement in the curriculum. As high schools increasingly incorporate a similarclass into their curriculum, entering university freshmen, some argue, should already possess introductory-level computer skills. Indeed, an increasing number of students are "testing out" of the introductory computer applications course. Further, almost every major within the School of Business has recently changed its core requirement to the advanced microcomputer applications course, not the introductory course. Should the introductory computer applications course, then, be considered remedial? Have most students already mastered the skills taught in the introductory course? Is its content appropriate for its clientele? Does it serve the preparatory role it should for the advanced class? Perhaps, just as a minimum level of English and math competency is expected, the time has come to expect a minimum level of computer skills upon college entrance.

HYPOTHESES AND METHODOLOGY

The hypotheses of the study were that students entering the introductory-level computer course: 1) have had prior experience with word processing, spreadsheet, database, and presentation software; 2) have used email; 3) have used the Internet for entertainment but not as an educational or business tool; and 4) own a computer.

To obtain information to develop a profile of students entering the introductory computer applications course, an instrument was developed and administered to 85 students in the on-campus classes during the Spring semester of 2000. Of those, 72 usable surveys were obtained. The survey will be administered again during the Summer sessions of 2000 (currently 60 students are enrolled) and Fall 2000 (probably, 200+ students).

The instrument was constructed to obtain information concerning the type of computer(s) previously used, the nature and location of any experience indicated, access to a computer away from the university, and demographic data. Previous computer usage was addressed by questions concerning the time spent using a PC and/or a mini or mainframe computer and the classification of any computer(s) personally owned. The nature of the respondent's computer experience was assessed by questions concerning the amount of time spent using email and the Internet as well as questions concerning proficiency with specific software applications. The location of the respondent's experience was obtained from questions concerning the number of semesters of course work completed in an educational environment and on-the-job training.

PRELIMINARY FINDINGS

This study nor its analysis is complete. Preliminary results, however, do point to some interesting findings. The first hypothesis was that students entering the introductory-level computer course have had prior experience with word processing, spreadsheet, database, and presentation software. Word processing and spreadsheets were the only software applications with which a majority of the students claimed to have a degree of proficiency, and 10% claimed no prior computer experience at all.

The second hypothesis was that students entering the introductory-level computer course have used email; yet 58 percent of the students reported no email usage. Another hypothesis was that students entering the introductory-level computer course have used the Internet for entertainment but not as an educational or business tool. A surprising 63% of respondents indicated no Internet usage. Of the 40% who did use the Internet, almost half was for pleasure. That leaves only 20% of our students using the Internet as an educational or business tool. The final hypothesis was that students own a computer, and indeed, 75% of all respondents indicated that they owned a computer.

As computers continue to penetrate the fibers of life, educators strive to keep pace. Since the field of computers is probably the most radically changing of all fields, constant new research and frequent repetitions of research are necessary to evaluate the correctness of current and future educational goals. This endeavor is but one step toward "keeping pace."

ASYNCHRONOUS LEARNING TOOLS IN THE TRADITIONAL CLASSROOM — A PRELIMINARY STUDY ON THEIR EFFECT

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ABSTRACT

Asynchronous learning (ASL) tools are being used at colleges and universities in many countries around the world, but the majority of implementations are to enhance or support the traditional classroom environment rather than to provide asynchronous on-line classes. This paper presents a succinct review of some major issues that have caused this situation. It then looks at four ways that a particular ASL tool, Blackboard, is used at one school to support traditional lecture courses. The paper looks at several quantitative measures that can be used to determine if the use of the ASL tool has any significant effect on learning and the learning environment. The results of a study that analyzed forty-three Blackboard supported courses are presented. It describes a logical methodology to evaluate changes in student performance in a quantitative manner. The study notes that high use of the ASL tool in supporting the class consistently results in an improvement in the learning environment based on significant changes in two or more quantitative measures. The study also presents a brief review of qualitative comments that highlight student concerns about the use of ASL tools in traditional classes. The paper ends with a discussion of some important issues for those planning to use ASL tools to augment or support traditional courses and areas for further research and study.

INTRODUCTION

Web based asynchronous learning is an area of rapid growth. In a period of three years from 1995-1998 the number of schools in the United States interested in developing such programs increased by almost 200 percent (Morse, Glover, and Travis, 1997, Phillips-Vicky, 1998.) There is much controversy about the efficacy of distance education in higher education. Comments are varied and no one seems to know what the final impact of distance education will have on traditional programs. Abernathy (1998), Binde (1998), Farrington (1999), Smith (1998), and Theakson (1999) all discuss some of the current issues involving the use of technology in distance education and its potential to revolutionize education. The impact of the programs is unclear. Carnevale (2000) highlights faculty issues in distance learning, and Blumenstyk (1999) and Daniels and Rubin (1998) focus on some shortcomings and how several programs have not been successful. Poley (1998) describes some specific examples of distance learning in American universities and schools around the world. Wilson and Meadows (1998) discuss issues in distance education for schools in Australia who often use organizations in Asia to assist in delivering international information-age education.

Several companies are producing software packages that provide an environment for faculty to develop courses that can then be presented in an asynchronous distance learning format. Most of these products allow students to use a web browser to view and use course materials with no special software required, and they vary widely on the investment in time, money, and computer assets for implementation. All ASL tools place some restrictions on what material can be presented, how it can be presented, and also the types of interaction provided. Considering the limitations exhibited by most of these products, many schools are using them more to augment traditional courses rather than using them solely to provide stand alone distance education courses. This paper looks at how one ASL tool, Blackboard, is being employed in a variety of courses at one university. It then looks at four measures to determine if there is any quantitative difference in course outcomes when courses that use Blackboard to augment classes are compared to courses that didn't use the tool.

BACKGROUND

The use of ASL started in the 1980s, when some faculty and students began to teach and learn asynchronously using e-mail (McMullen, Goldbaum, Wolffe, & Sattler, 1998). As the Internet and browser technologies have improved, there has been a major move by schools and vendors to utilize this medium in a variety of ways. The limitations of these systems are those inherent in using technology as a means of presenting education such as restricted instructional methods, limited means of communication and feedback. Speed of transmission is also an important issue as it determines just how much or how little information can be effectively received by students.

Three recent studies (Rogers and Laws, 1997, Coyle et al., 1998, Novitzki, 2000) identified several characteristics and qualities which must be present in an academically sound on-line asynchronous course. The three most critical factors are: It should be a self-contained standalone package that is convenient and easy to use and which depends on nothing else. Second, it should provide as far as possible the same educational experience as the traditional class. Third, it should provide for easy interaction with the instructor and other students. No current ASL tool fully satisfies all of these requirements, and as a result few schools have been successful in putting large numbers of on-line courses or whole degree programs on the Internet without extensive vendor support and assistance. At a recent meeting sponsored by Blackboard (Blackboard, 2000), it was reported that the ratio of courses used to augment traditional courses to on-line courses was 15:1, fifteen augmented courses for every full on-line course. In spite of this large preponderance of augmented courses to on-line courses, little has been reported quantitatively on the impact that ASL technology in this format has on students, courses, or instructors.

In 1997-98 our school, whose focus is providing graduate business education to working adults on a part time basis, conducted an analysis of the various ASL tools available to develop and offer courses in an asynchronous on-line environment. There are a large number of ASL tool vendors who vigorously market and promote their wares (Abernathy, 1998, Blumenstyk, 1999, Frederickson, 1999, Hiltz and Welman, 1997). Several of these vendors made presentations and, based on our needs and their capabilities, Blackboard was chosen as our standard ASL tool for on-line course development and support (Novitzki, 1999).

CURRENT STUDY

The use of Blackboard in courses has varied across the departments at our school. Development of the ASL supported courses has been spreading slowly due to limited assets and technical support. When faculty and staff were learning the tool, only a few instructors could be involved. They began slowly, initially starting at low use levels, and then moving to higher levels of use in later terms. In the beginning the Information Technology (IT) department was the main Blackboard user, but later, as assets permitted, other departments have been getting more involved in the technology. Table 1 clearly shows how other departments have become more involved in the use of Blackboard. Its use has evolved into four different formats, little use, moderate use, extensive use, and on-line courses. Low use consisted of putting up a detailed web page that described course goals, objectives, and requirements and which provided the syllabus and assignments. No lecture materials were provided, nor was any testing. Assignments were posted as part of syllabus, but they were not augmented or supported by the ASL tool. There was no option provided for students to communicate with each other through the Blackboard software.

Moderate use started with the same web page described above, but lecture notes, slides, and other supporting material were also available on Blackboard. Instructors often added links to other information sources and quizzes. If students communicated with the instructor outside of class, it was through the use of regular e-mail, not through Blackboard. Normal lectures were held each week and the material available through Blackboard was designed to augment and explain the material in the lectures as well as repeat key material covered in class. Material on Blackboard was referred to during classes, and students were encouraged to review and use the on-line material

Extensive use involved all of the features described above, but also required assignments to be submitted on-line using features found in Blackboard. Additionally, these courses used the various communication features of Blackboard. Bulletin boards, threaded discussions, and chat rooms are all used to augment the class lectures and materials. All class materials were submitted via e-mail and graded by the instructor similar to that described in Braught et al (1998).

On-line classes have operated generally as extensions of the extensive use format. The differences being that students do not attend traditional class lectures, and most instructors provide some sort of audio lecture materials. The use and effectiveness of these courses is beyond the scope of this paper and the on-line courses will not be discussed further.

RESEARCH QUESTION

From an educational standpoint a key question is, with all the effort and time spent on this technology by schools across the United States, has the use of an ASL tool enhanced the educational experience in a quantifiable or measurable way? There is a lot of anecdotal information that points to better feelings by students, more interaction, better questions, etc, but little has been done looking at quantitative measures. A major purpose of this study was to make a preliminary determination if there were any measurable gains noted in using an ASL tool to support traditional lecture classes. Secondary questions were, at what level does the tool use begin to demonstrate some effect on the student and course outcomes, and is there a point of diminishing returns at which point an increase in the use of the tool has no effect on the measured outcomes?

METHODOLOGY

This study was based on a convenience sample not a randomized experiment. Courses used were those with an instructor who was interested in using the ASL software, and were not randomly assigned. There was no selection of students for the various sections. Students who registered for courses were participants unless they selected themselves out by dropping the course. No course was noted as being a special section so there was a random chance for students to be involved. All classes described used Blackboard to augment the course in some manner, but the level use was up to the instructor and depended largely on their comfort level with the ASL tool.

Several measures were used to determine if the use of the tool impacted the learning environment. First, what was the average grade obtained by students in the course? Did it change? To minimize extraneous factors only previous sections of the same course taught by the same instructor were compared. This information was obtained from the final grade report. Second, did the average final exam grade change? Even though these are all graduate level courses, and exams are typically only a small part of the final grade, it was important to see if there was a direct link in knowledge as measured by tests. Instructors administered the same test to both the regular course and the ASL supported course. Student exam grades were obtained from instructors. Third, did the student evaluation of the course change? All students rate courses on the learning experience, how well it communicates course information, and how much they learned? The same instrument was given to both the traditional and the ASL augmented classes. The last quantitative measure was how did the students evaluate the instructor? Was the instructor seen as being different when evaluated by the traditional or the ASL supported course? This information was also obtained from the course evaluation form. Finally, a qualitative cross check was accomplished by looking at student written comments discussing the course experience. The measurement tools were the usual course evaluation form, which was not modified in any way for the study, and a special Blackboard survey form that students filled out at the end of the term.

Courses taught during calendar year 1999 were used as the sample for the study, and they were chosen for several reasons. It was the first year when there were enough courses run using Blackboard to obtain a reasonably sized sample. The ASL tool had become reasonably stable during this period, and both faculty and technical staff were familiar enough with Blackboard that technical problems did not affect the classes. Table 1 summarizes the numbers of courses taught in the various formats by different departments in each term during the year.

The key to determining the effect of some intervention is to have a solid baseline on which to measure differences. For this study the base line used was the most recent evaluations of the course taught by the same instructor, in the same format, without the use of the ASL tool. Data was collected on each Blackboard course and the corresponding baseline course.

TABLE 1
SUMMARY OF FORMATS AND IMPLEMENTATIONS

Format	Spring 99	Summer 99	Fall 99
Little Use	IT (3)*	None	IT (2) MBA (2) MKTG (1)
Moderate Use	IT (5)	IT (8)	IT (17) MBA (3) MKTG (2)
Extensive Use	IT (3)	IT (3)	IT (4) MBA (1)

*Numbers in parenthesis are the number of Blackboard supported classes run by that department.

Not all of the Blackboard augmented courses taught in calendar year 1999 could be used in the study. Some courses were new and had not been taught before, and several instructors had not taught some of the courses in a traditional lecture class setting. In the extensive use courses, three of the eleven classes could not be used for these reasons. In the moderate use courses, there were seven classes that could not be used. In the low use courses, one class could not be used. The result was that the course comparison for this study includes seven (7) low use courses, twenty-eight(28) moderate use courses, and eight (8) extensive use courses.

RESULTS

Appendix A presents the raw data for all of the courses used in the study. It gives the course grades, course evaluations, and instructor evaluations for all forty-three (43) courses, and final exam scores for the twenty-three courses that had final examinations. The raw numbers indicate several points. First, in only a few cases are the differences numerically large. Second, in many cases the differences do not always show a numeric change indicating a positive impact of the technology. This means that for some students, the use of the ASL tool actually detracted from the learning experience. Lastly, the increased use of the tool usually resulted in higher numerical evaluations for the course and the instructor.

Chi-square tests for difference were performed on each course. Results were compiled and placed in Table 2. Observed Chi-square values and the critical Chi-square values for the 0.05 level of significance are shown. None of the low usage courses had a significant difference for any of the four quantitative measures. Of the moderate use courses, the results were variable with two measures, course and instructor evaluation, showing significant increases and two, final exam score, and final grade, having no significant difference. Extensive use courses resulted in significant increases in all areas except the final exam scores.

FINDINGS

Table 3 summarizes the findings of the study. Several points can be observed in the information presented. First, low levels of usage of the ASL tool resulted in no significant effect on any of the measures employed in the study. Even a review of the raw data in Appendix A fails to show any numerical indication of a consistent effect. Second, for moderate levels of usage, while examination and course grades had no significant differences, there was a marked variation in the raw scores for both these measures as shown in Appendix A. Use of the ASL tool did affect students as both the course and the instructor evaluations increased a significant amount. Extensive levels of usage had a significant effect on all measures except the final exam scores. The scores were all numerically higher as shown in Appendix A, but not statistically so. No reason could be postulated for the lack of a significant statistical change in that measure when the course grade was affected significantly.

TABLE 2
CHI-SQUARE TEST RESULTS

	Final	Exam	Course	Grade	Course	Eval	Instruc.	Eval
	OBS X	Crit. X	OBS X	Crit. X	OBS X	Crit X	OBS X	Crit X
Low Use	2.0215	7.815	8.512	12.592	9.651	12.592	6.342	12.592
Moderate Use	8.3865	26.119	24.976	40.113	40.161	40.113	41.241	40.113
Extensive Use	4.4711	9.488	14.412	14.067	18.104	14.067	16.724	14.067

TABLE 3
RESULTS OF CHI-SQUARE TEST FOR SIGNIFICANT DIFFERENCE

FORMAT	Measure	X-square	Meaning
Low Use	Final Exam	2.0215	Not Significant
	Course Grade	8.512	Not Significant
	Course Eval	9.651	Not Significant
	Instrc Eval	6.342	Not Significant
Moderate Use	Final Exam	8.3865	Not Significant
	Course Grade	24.976	Not Significant
	Course Eval	40.161	Significant
	Instrc Eval	41.241	Significant
Extensive Use	Final Exam	4.4711	Not Significant
	Course Grade	14.412	Significant
	Course Eval	18.104	Significant
	Instrc Eval	16.724	Significant

DISCUSSION

The results do in fact support the hypotheses and questions stated earlier. There does seem to be a statistically significant difference in student performance as noted by the measures used. This effect is ameliorated by the type of interaction that students have with the ASL tool that is used. In low usage course there is little student interaction and therefore no impact or difference. The numerical differences noted in Appendix A could have occurred by chance.

In the moderate usage courses, while some measures show a significant improvement, there is high variability in numeric scores. Some courses showed high impact, some moderate impact, some low pact, and the rest none. This could be because of three factors, which were not considered in this study. First, the course subject could have an effect. Some subject matter needs extensive explanations to facilitate understanding and others do not. The second variable is the manner in which the course was actually conducted. Although the instructors were supposed to use the tool in certain ways, those with different skill sets might not effectively use all of Blackboard's capabilities, which could affect the results. Third, student response to the ASL tool was highly inconsistent; those with some technical knowledge seemed to enjoy it more than students with little or no technical knowledge.

In the extensive usage courses, there was almost universal improvement, and all but the final exam scores were significant. This level of usage resulted in the most consistent improvement of all of the raw comparison data. The electronic based assignments, chats, and discussions seem to reinforce the material and create a greater impact than merely presenting the data and then referring to it.

Qualitative Comments

There were no comments about the use of Blackboard by students who had only low level usage of ASL tool on the end of course evaluation. Table 4 shows that the time spent with Blackboard by students for the entire term was barely more than half an hour per student. The evaluation form indicated that most students didn't use it if there was no requirement to use the tool. Students, who used Blackboard, read the course syllabus, but only a few bothered to review assignments on the web page.

TABLE 4
SUMMARY OF BLACKBOARD TIME USE BY ASL TOOL USAGE

Tool	Time use	
Low Use	Mean = 0.5 hr.	S.D. = .6 hr
Moderate Use	Mean = 12.1 hr	S.D. = 3.4 hr
High Use	Mean = 19.6 hr	S.D.= 2.7 hr
On-line	Mean = 26.5 hr	S.D. = 3.9 hr

In the moderate level of usage format there was a significantly higher use of the computer-based materials, and table 4 shows an increase of over 24 times over the low usage courses. The biggest factors for increased usage were the requirement to use the ASL tool for several assignments, and the availability of some materials for the course only on the Blackboard website. Few students noted problems with the course. Student comments highlighted the ability to do work for the course when they wanted and having more material available than from a regular course.

In the third format, extensive usage of Blackboard, the use of lecture materials, notes, and supporting documentation on the tool was considerably higher than in the moderate usage format, even though there was no significant difference in the amount of supporting materials provided. The Blackboard evaluation form revealed that as the course went on, students used less and less of the supporting materials. E-mail usage remained high throughout the term with more interactions between students via e-mail than in the previous cases. The threaded conversations were used heavily initially, decreased in the middle, and increased again towards the end of the term. An online chat was used weekly, but its usage too mirrored that of the threaded discussions. Participation in the threaded discussion seemed to be the most effective way to gauge and evaluate class participation.

In the extensive usage classes most students also commented that they felt they put in more work than in a traditional class, because the instructor was able to ask questions on-line and all students had to respond. It was not possible to skip the readings, and then hope not to get called. Several students stated that the threaded discussions and the e-mail/chats were the most useful part of the course. Students enjoyed links to current topics or sources as they reinforced the connection between theory and practice and often gave current examples of successes and/or failures. They were emphatic about the need for more courses using ASL tools and the need for full on-line courses. They did not indicate any concerns about the limited interface with other students or having any problems with access to the instructor. Overall students were positive about the use of Blackboard as an ASL tool.

There were some negative comments too. One complaint was the delay with instructors responding to questions and grading assignments. Students seemed to believe that if they sent an e-mail out at 2 a.m., it should be answered immediately, or by the early morning at the latest. Equipment issues were a problem initially. Even though everything could be handled through a web browser, some students still had equipment problems. A major issue was the use of audio and video clips, which had been provided by some instructors to add some variety to the materials or to make special points for lectures. Many students felt they were not worth the trouble, and many could not get adequate performance from their systems to view some of the video. Students who used browsers in the computer lab complained that the computers had no speakers, so audio clips could not be heard. They felt that many of the lecture notes and much of the material presented merely restated material from the text. The biggest complaint was that although there was a variety of ways to communicate with the instructor and students outside of class, most were not intuitive and required time and patience to use. Most students felt that for a single class that this might not be a serious problem, but for a continuing program, it would be a serious limitation. Even students who made these comments were still generally positive about the experience.

CONCLUSIONS

The information reported here is from a small non-randomized sample from one university so no statistically valid general inferences can be made. Another limitation is that the only instructors included in the study are those who volunteered to use the ASL tool. Several obvious points can be noted. The use of an ASL tool is not a panacea or replacement for a poor instructor. When implemented correctly, it can have a significant effect in a positive manner, but if implemented poorly it can have a negative effect.

Most of the ASL tools currently in use are still not mature. Each revision makes products more powerful, stable, and functional, but it will be some time before they can fully do what the students and instructors need and want to fully support on-line courses. Since less than 50% of current offerings from ASL tool vendors are stand alone on-line courses, it is important to determine if the use of these tools to augment traditional courses is educationally effective. The findings reported here indicate that the use of Blackboard to augment traditional courses can have significant impact on student performance and attitude.

This preliminary study validates the use of four quantifiable measures as methods to determine the efficacy of the ASL tool use in various formats of augmenting traditional classes. Student use of the course material and the time figures in Table 5 clearly show that no student spends as much time reading material off the screen as either the instructor or course designer believes. Hodes (1993) points out that most students prefer the textbook and hard copy notes to reading extensive on-line notes and materials.

Discussions with instructors indicated a high level of effort to prepare and teach with the ASL tool at the moderate and extensive usage levels. Abernathy (1998) and Kerka (1996) reinforce the point that Skinner (1968) made over 30 years ago that textbooks, lecture outlines, film scripts, etc. are of little help in preparing course material for asynchronous learning. Instructors also noted a requirement to have a good working knowledge of the software and limitations. In the first few classes software and equipment questions were as common as course material questions. These comments compare closely with those observed by Harasim (1991) that rapid resolution of technical problems by the instructor is critical for student learning.

FUTURE STEPS

The use of an ASL tool to augment a traditional course seems to have an affect on student attitude and performance. The work here is a preliminary study, and while its findings are interesting and support the stated questions, more data must be accumulated and tested before any definitive statements can be made. It does at least show the potential for the use of ASL tools in this mode to improve student performance, and educational environment. Several steps are planned after this study. With the spring semester there should be sufficient data to look at individual courses to determine how course content impacts the effectiveness of the ASL tool to enhance learning. Second, a longitudinal study is planned to determine if the course evaluations change over time for the same instructors. The possible capability of ASL tools to enhance learning in traditional courses is an important issue which must be fully explored.

REFERENCES

Abernathy, D. J. (1998). "The WWW of Distance Learning: Who Does What and Where? *Training and Development*, 52(9), 29-32.

Binde, J. (Oct 1998) "Communication and Intelligence: Distance Education and Culture? *Future*, 30(8), 843.

Blumenstyk, G. (1999, April 9). "The Marketing Intensifies in Distance Learning. *The Chronicle of Higher Education*, pp. A27-30.

Bortz, F. (1998). "Real Learning, Anyplace, Anytime. *Carnegie Mellon Magazine*, fall, p19-20.

Braught, G.W., Laws, P.W., & Ward, D. (1998). "Collecting Homework on the Web. *Syllabus-new Directions in Education Technology*, 12, (3) 49-51.

Carnevale, D. (July 2000). "Faculty Union Opposes Undergraduate Degrees Earned Through Distance Learning. *The Chronicle of Higher Education*, 46(46), A32.

Coyle, P., Evans, K., Fleischman, B., Gaither-Scott, A., & Little, K. (1998). *Strategic Plan for an On-line Course Model*. Unpublished graduate applied project, Johns Hopkins University.

Daniels, S. & Rubin, D.K. (1998). "'Virtual' Courses Are Real Dilemma. *ENR*, 241(18), 10.

Farrington, G. C. (July/Aug 1999) "The New Technologies and the Future of Residential Undergraduate Education. *EDUCOM Review*, 34(4), 38-41.

Frederickson, S. (August 1999). "Web-Based Instruction: A Comparison of Ten Programs. Paper presented at the *15th Annual Conference on Distance Teaching and Learning*, Madison, WI.

Gagne, R. M., & Briggs, L. J. (1974). *Principles of Instructional Design*. New York: Holt, Rinehart and Winston, Inc.

Green, K. C. (1997). "Think Twice and Businesslike about Distance Education. *AAHE Bulletin*, 50 (2), 3-6.

Harasim, L. (1998). "Teaching by Computer Conferencing. In A. Miller (Ed.), *Applications of Computer Conferencing to Teacher Education and Human Resource Development* (pp. 25-33). Proceedings from an International Symposium on Computer Conferencing, Columbus, OH.

Hiltz, S. R., & Wellman, B. (1997). "Asynchronous Learning Networks as a Virtual Classroom. *Communications of the ACM*, 40(9), 44-49.

Hodes, C. L. (1993, July). "Delivery System Preferences for Nontraditional Learners. Paper presented at the *Second Annual Meeting of the Global Awareness Society*, New York.

Kerka, S. (1996). *Distance Learning, the Internet, and the World Wide Web (Report No. EDO-CE-96-168).* ERIC Clearinghouse on Adult, Career, and Vocational Education, Columbus, OH. (ERIC Document No. ED 395 214).

Mayadas, A. F. (October 1997). "Online networks build timesavings into employee education. *HR Magazine*, 42(10), 31-35.

McMullen, D. W., Goldbaum, H., Wolffe, R., & Sattler, J. (1998). "Using Asynchronous Learning Technology to Make Connections among Faculty, Students, and Teachers. Paper presented at the annual meeting of the *American Association of Colleges for Teacher Education, 50th*, New Orleans, LA.

Morse, G. E., Glover, H., & Travis, J. (December 1997). "Survey of Distance Education Utilization in Information Systems Departments. *Proceedings of the 12th Annual Conference of the International Academy for Information Management*, 12, 70-77.

Novitzki, J. E. (December 1999), "Asynchronous Learning Tools: What Is Really Needed? *Proceeding of the International Academy of Information Management*, 14,86-97.

Novitzki, J. E. (February 2000), "Asynschronous Learning Tools, Which Is the Best? *Distance Learning Strategies and Solutions* Ed by Anil Agarrwal, pgs 42-64.

Poley, J. K. (1998). "Distance Education for American Universities and the World. *American Journal of Agricultural Economics*, 80(5), 973-978.

Phillips-Vicky, A. (1998). "Virtual Classrooms, Real Education. *Nation's-Business*, 86(5), 41-45.

Rogers, C. S., & Laws, P. (1997, April). *Successes and lessons learned in an on-line course on socioemotional development.* Paper contributed to "Trends and Issues in on-line instruction the second Teaching in the Community Colleges on-line Conference at Kapiolani Community College.

Skinner, B. F. (1968). *The technology of teaching.* New York: Appleton-Century-Crofts.

Smith, G.M. (1998). Education poised to go the distance. *National Underwriter*, 102, 43, 3-6.

Theakton, C. (1999). How technology might aid distance-learning MBA students: Using Durham University Business School as a case study. *International Journal of Information Management*, 19(5), 413.

Wilson, R.E. & Meadows, C. J. (1998). Tele-teaching: Australia's competitive question. *Global Information Management*, 6(1), 15-26.

APPENDIX A
SUMMARY OF BLACKBOARD USE AND EVALUATIONS

Tool	Final Exam		Student Grade		Course Evaluation		Instructor Evaluation	
Format			BlckBrd	Baseline	BlckBrd	Baseline	BlckBrd	Baseline
Low Use	92	92	3.37	3.41	3.12	3.10	3.10	3.08
	91	91	3.78	3.73	3.45	3.48	3.32	3.29
	94	93	3.43	3.44	3.29	3.28	3.08	3.09
	93	92	3.45	3.43	3.48	3.46	3.01	3.01
	NA	NA	3.32	3.34	3.32	3.33	2.96	2.95
	NA	NA	3.19	3.24	3.27	3.26	3.21	3.23
	NA	NA	3.35	3.35	3.32	3.34	3.14	3.13
Moderate Use	95	92	3.90	3.96	3.19	3.44	3.41	3.11
	93	92	3.81	3.73	3.50	3.79	3.76	3.37
	92	91	3.78	3.88	3.49	3.54	3.69	3.29
	91	90	3.97	3.38	3.43	3.36	3.33	3.09
	94	93	3.29	3.30	2.86	3.24	3.42	3.08
	92	92	3.90	4.00	3.25	3.47	3.73	3.47
	92	91	4.00	3.91	3.62	3.60	2.99	3.03
	91	90	3.86	3.85	3.72	3.68	3.51	3.19
	93	91	3.94	3.92	3.55	3.56	3.34	3.03
	96	93	3.88	3.89	3.70	3.69	3.44	3.05
	91	90	3.76	3.75	3.79	3.75	3.33	3.12
	92	90	3.84	3.86	3.35	3.33	3.23	3.03
	93	91	3.16	3.13	3.27	3.27	3.38	3.17
	94	91	3.36	3.37	3.34	3.33	3.50	3.11
	NA	NA	3.41	3.40	3.66	3.65	3.66	3.33
	NA	NA	3.47	3.42	3.32	3.31	3.47	3.25
	NA	NA	3.70	3.65	3.21	3.19	3.64	3.24
	NA	NA	3.69	3.67	3.46	3.46	3.58	3.17
	NA	NA	3.29	3.30	3.59	3.58	3.56	3.25
	NA	NA	3.11	3.14	3.33	3.33	3.73	3.40
	NA	NA	3.90	3.86	3.02	3.05	3.27	3.02
	NA	NA	3.94	3.92	3.47	3.45	3.65	3.15
	NA	NA	3.37	3.36	3.54	3.49	3.12	3.01
	NA	NA	3.76	3.75	3.59	3.57	3.53	3.22
	NA	NA	3.24	3.25	3.69	3.68	3.72	3.26
	NA	NA	3.46	3.44	3.23	3.21	3.64	3.41
	NA	NA	3.56	3.51	3.27	3.24	3.52	3.42
	NA	NA	3.61	3.59	3.41	3.40	3.83	3.38
Extensive Use	96	93	3.43	2.35	3.62	3.28	3.72	3.19
	95	94	3.76	3.86	3.82	3.64	3.83	3.58
	96	92	3.75	3.76	3.55	2.61	3.55	3.30
	94	93	3.88	3.95	3.80	3.46	3.79	3.50
	95	91	3.84	3.77	3.75	3.51	3.62	3.39
	NA	NA	3.37	3.34	3.71	3.49	3.59	3.48
	NA	NA	3.55	3.42	3.68	3.36	3.74	3.42
	NA	NA	3.90	3.86	3.79	3.47	3.66	3.32

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UNIVERSITY INTERNET SERVICES: PROBLEMS AND OPPORTUNITIES

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ABSTRACT

This paper presents the findings of a study on the use of World Wide Web pages among students at St. Cloud State University, Minnesota, USA. The paper explores problems and challenges on campus Web computing and the relationships among the extent of Web usage, class level, and overall student academic performance. The paper concludes with a discussion on improving the effectiveness of campus Web services.

INTRODUCTION

The rapid advance of Web based technology has created a major challenge to Universities and Colleges in classroom teaching. It changed the nature of information technology service used in education (Hong, 1997). At the end of the 1990s paperless classrooms began to emerge at many colleges and universities (Bialac and Glover, 1997). The academic world has seen an enthusiastic rush of faculty to the WWW as the new mode of interaction with students. Syllabi, projects, handouts, and tutorials even entire course and curriculum are placed on the Web not only as a new mode of distance learning but also as a supplement to traditional mode of face-to-face classroom instruction. According to a recent survey of campus officials and IT managers across the United States, more than one-fourth (28%) of college courses are supported by a Web page, and thirty-nine percent of all courses are using Internet resources as part of the course requirements (Nelson, 1999).

The increased use of Web technology as a tool for instruction and research by faculty and students creates challenges and problems for academic computing management. Schools are facing challenges of upgrading and expanding computing facilities. Faculty support and instructional integration have become the most important IT functions in recent years (Thiele, 1999). The problems that affect student effective learning include lack of knowledge on how to use computers, unstable technology in use, slow Web access speed, lack of available hardware and software among others. Ultimately, to improve effectiveness and maximize the benefits of Internet usage in education, solutions are needed to minimize these problems and to increase the satisfaction of faculty and students who use the Web technology.

The purposes of this study are (1) to identify campus Web related problems from student perspective (2) to conduct a preliminary investigation into the relationships among student computer skills, frequency of reported Web related problems, student performance (GPA). It is hoped that the study results will help us understand the types of Web related problems that college students experience, the factors might contribute to the difficulties, and whether frequency of Web usage is related to student overall performance. The paper is organized as follows. After a review of current issues in university Internet services, a brief descriptions of the computing facilities of the two campuses in the study are provided. Then research methodology and findings are discussed. The paper concludes with a summary and some suggestions for improving campus Internet services.

CURRENT ISSUES IN UNIVERSITY INTERNET USAGE

Technology resources like e-mail, FTP, the World-Wide Web (WWW), and multimedia are increasingly common components of the instructional experience for college students. Additionally, growing numbers of campuses now have a computer competency or computer instruction requirement for all their undergraduate students. According to the Kenneth C. Green (1997), visiting scholar at the Center for Educational Studies at Claremont Graduate University, "Technology resources are becoming an increasingly important component of the instructional experience, across all fields and all types of institutions." The use of information technology (IT) as an instructional resource is highest in research universities. However, Green notes that the gains have occurred in all types of colleges and universities: "Although students in universities are more likely to encounter IT resources in their classes than their peers at four-year colleges or community colleges, the survey data document the expanding use of IT resources across all sectors of American higher education."

Seemingly endless streams of Internet users present problems of traffic control and overall accessibility. Already, the Internet is frequently overloaded with electronic messages. Demand for ever larger e-mail volume, multimedia content, real time broadcasting, electronic meetings, download of free software, music, and games, and a host of developing technologies and applications will continue to tax the existing infrastructure of US colleges and universities. Brownouts and overloaded networks are increasingly common as traffic on the Internet continues to grow faster than bandwidth capabilities. For colleges with limited budgets and computing resources, keeping up with the increasing demand by bandwidth hungry students for Internet access is particularly difficult. Computing resources at college and universities often lag behind the increase in web access from students.

This situation has not gone unnoticed. The recent survey of chief academic computing officers respondents by The Campus Computing Project (1999) also identified "assisting faculty integrate IT into instruction" and "providing adequate user support" as the top IT challenges confronting their institutions. Almost 40% of institutions identified "instructional integration" as the single most significant IT issue in their institutions, followed by 28% citing "providing adequate user support." IT financial planning for replacing aging hardware and software ranked third at 14%.

INTERNET ENVIRONMENT AT ST. CLOUD STATE UNIVERSITY

St. Cloud State University (SCSU) is a comprehensive university located about 65 miles northwest of Minneapolis/St. Paul Minnesota. The University consists of seven colleges and a graduate school and offers over 60 baccalaureate degrees, several masters degrees, and one doctoral program . St. Cloud State University currently serves a student population of 14,000 and has approximately 1000 employees. Class rooms, computing laboratories, departmental and faculty offices, and dormitories are all wired into the fiber optic based campus network. As with most colleges and universities demand for Internet services at St. Cloud State University has increased dramatically within the past few years.

St. Cloud State University is served by MNET, which provides Internet services to Minnesota government agencies and educational institutions. A T1 communications line connects St. Cloud State University to the regional Internet hub in St. Paul. Hundreds of computers on campus are cabled directly into the campus network via Ethernet adapters. Token Ring LANs connect buildings and laboratories on campus. A bank of 330 highspeed modems provides dial-up access to the University network.

While there have been numerous discussions over the years, there are currently no university-wide standards for desktop hardware, operating systems, applications software, Web browsers, or email packages. However, good support is available for the most popular configurations and applications those who choose to deviate from the "beaten path generally find themselves without support. Most of the open computing laboratories are maintained by Academic Computing Services, the others are maintained by department or college.

Centrally, the University maintains two general usage multiprocessor Digital Equipment Corporation Alpha class (one runs the VMS operating system; the other runs

UNIX) email and Web servers. Both machines are available for faculty and students e-mail and Internet usage. Basic user training in e-mail operations, web surfing and home page development is provided at no cost to students and faculty by Academic Computing Services; advanced training is provided through numerous courses offered by various departments across campus, primarily to their own major and minor students. For maximum flexibility and control, many departments now maintain their own (primarily Windows NT 4.0) servers, which are also connected to the campus topology. A few individual faculty members have installed server software on their own computers allowing students to access files and Web pages directly from machines in the faculty member's office.

Many of the needed Web development tools are readily available to faculty and students: a variety of plain text and HTML editors, Front Page, Java Script authoring tools, and Java compilers. An open multimedia lab offers digital capture, production, and editing capabilities.

METHODOLOGY

Study Design

The study is designed to proceed in three steps: (1) identify major problems, (2) analyze the frequency of the problems, (3) test hypotheses.

Null Hypotheses

Based on common pedagogical knowledge that web pages can be effectively used in teaching at colleges and universities, the following null hypotheses (Ho) are formulated:

1. Class level does not influence the frequency of weekly web accesses. We commonly believe that the higher the class level, the higher the needs to access the web for class projects and research.

2. Frequent visit to the web does not have impact on GPA and vice versa. Frequent Web usage may either help students' performance or decrease students' performance, depending on what the students use Web for. Spending time on Web for playing games and chatting will negatively affect students' performance. On the other hand, students who use Web for researching term papers and looking for references and online academic help are expected to perform better.

3. Slow web access does not impact the frequency of web usage. Does perception of slow access prevent students from going into the web frequently?

4. Problems with hardware and software do not impact the frequency of web access. Do problems associated with hardware and Internet software prevent students from accessing the web frequently?

5. Recognition of Web's value in research does not lead to frequent web access. Do students who appreciate Web's value in research access the web more frequently?

6. Rating of University's Internet Service is not influenced by student's class level. Do students rate Internet service provided by the university influenced by student's class level?

7. Appreciation of Web value in research is not influenced by student's class level. Do students at higher class level appreciate value of the Web more than students at lower class level?

8. Rating of University's Internet and Web Services is not influenced by student's GPA. Do students who have high GPAs appreciate University's service more than students who have lower GPA?

9. Recognition of Web's value in research is not influenced by student's GPA. Do students who have higher GPAs appreciate Web values' more than students who have low GPAs?

Survey Questionnaire

Two brainstorming sessions with students were conducted to produce a list of possible problems that students encountered while using the World Wide Web service provided by the universities on and off campus. The final list of these problems was used to develop the questionnaire. Items in the survey fell into three areas: (1) student academic background and frequency of web access, (2) problems that students faced, and (3) student level of satisfaction. Respondents were asked about the frequency of occurrence of the problems they encountered by selecting one of the five choices: never, rarely, sometimes, usually, and always. They were also asked to rate their satisfaction level ranging from worst (lowest) to excellent (highest).

Conducting the Study

During the period from the Fall semester 1997 to Spring semester 2000, 317 students of several classes at St. Cloud State University were surveyed. Participants were told in advance that the anonymous survey responses would be confidential. With some motivation to get out of the class early after completion of the survey, all students participated. Data collected were tabulated and analyzed using Statistical Analysis System (SAS) available on the University's VAX computer.

FINDINGS

Analysis of the results showed that the great majority of the respondents (71.7%) are seniors, followed by juniors (21.3%) and graduated students (6%). Nearly sixty nine percent (69%) of the respondents have an average GPA above 3.0. The average number of web accesses per week is 19.48 times.

Overall, the results showed satisfaction in using Internet facilities (Table 1). Sixty percent (60%) of the respondents rated university web services good to excellent and 51 percent gave good to excellent ratings for their research work.

TABLE 1
INTERNET USAGE RESPONSES

Usage	Number of Responses	Percent
Web Services		
Poor or below average	10	3.7
Average	97	35.9
Good	134	49.6
Excellent	29	10.7
Values in doing research		
Poor or below average	24	9.0
Average	115	39.5
Good	114	42.9
Excellent	23	8.6

TABLE 2
FREQUENCY OF REPORTED PROBLEMS

Problems	Frequency	Percentage
Slow Access Speed		
	Rarely or Never	16.2
	Sometimes	40.6
	Always or Usually	43.2
Lack of Color Scanner		
	Rarely or Never	35.2
	Sometimes	29.2
	Always or Usually	35.6
Lack of Image Editor		
	Rarely or Never	30.7
	Sometimes	32.0
	Always or Usually	37.3
Poor Text Editor		
	Rarely or Never	37.4
	Sometimes	32.3
	Always or Usually	29.3
Web Development Language Problems		
	Rarely or Never	21.9
	Sometimes	40.1
	Always or Usually	38.1
Outdated Support Software		
	Rarely or Never	29.3
	Sometimes	41.7
	Always or Usually	29.0
Problem in Upgrading Web Browsers		
	Rarely or Never	30.8
	Sometimes	30.1
	Always or Usually	39.1
Free Speech Limitation		
	Rarely or Never	40.6
	Sometimes	28.2
	Always or Usually	31.2
Problems with FTP		
	Rarely or Never	31.4
	Sometimes	38.3
	Always or Usually	30.4
Slow Network		
	Rarely or Never	18.1
	Sometimes	37.5
	Always or Usually	44.4

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Table 2
(continued)

Problems	Frequency	Percentage
Slow CPU		
	Rarely or Never	22.8
	Sometimes	32.7
	Always or Usually	44.5
Slow Modem		
	Rarely or Never	23.4
	Sometimes	30.8
	Always or Usually	45.8
Problems with Search Engines		
	Rarely or Never	41.9
	Sometimes	30.6
	Always or Usually	27.4
Outdated Internet Software		
	Rarely or Never	31.7
	Sometimes	41.8
	Always or Usually	24.5
Not Enough Computers in the Lab		
	Rarely or Never	37.8
	Sometimes	30.4
	Always or Usually	31.7
Crashes		
	Rarely or Never	32.5
	Sometimes	38.5
	Always or Usually	29.0

Despite the generally favorable results, problems in accessing web pages are evident as presented in Table 2. Chief among these are the complaints about the slowness which include high occurrence (always and usually) of problems caused by modem (45.8% of respondents), processor (44.5%), network (44.4%), and total access (43.2%). Other problems cited at always or usually occurrence levels include upgrading web browser to current level (39.1%), language for web page development (38.1%), lack of an image editor such as Photoshop (37.3%), not enough computers available in the labs (31.7%), unable to exercise free speech (31.2%), problems with file transfer facility (30.4%), crashes (29%), outdated support software such as MS Office or Image Editor (29%), poor search engines (27.4%), and outdated Internet software such as Telnet, FTP, etc. (24.5%).

Correlation Analyses

Based on Spearman rank correlation tests of hypotheses, H_0: $r = 0$ (i.e. there is no correlation between pairs of class levels, frequency of weekly accesses, software problems, value of research, etc.) with $p < .05$, this study accepts the some of the above Null hypotheses and finds no correlation between:

1. GPA of students and frequency of web access. There is no significant correlation between web access and academic success of students measured by GPA.

2. GPA and the value of the University's Internet Service. There is no difference in the evaluation of University's Internet service between students having high GPAs and those having low GPAs.

3. GPA and the recognition of the value of Web in research. Students appreciate Web value in research regardless of their level of academic performance.

4. Class level and the appreciation of University's Internet and Web Services.

5. Class level and the appreciation of Web facility in research.

However, at 5% significant level, some of the above Null hypotheses are rejected:

1. Students of higher classes reported less problems with slow network than students of lower class levels network (corr= -.2164, p=.0001, n=313).

2. Students of higher class levels made more access to the network than students of lower levels (corr= 0.14522, p=0.118, n=299).

3. Students who reported less problems with hardware and software access the system more frequently. The rank correlation results between frequency of access and: (1) slow access speed (corr=-0.14604, p=.0125, n=292), (2) File transfer facility (corr= -.13386, p=.0233, n=287), (3) slow network (corr=-.21016, p=.0002, n=300), and (4) slow CPU (corr= -.14003, p=.0165, n=293).

4. Students who made frequent access also complained more problems with free speech caused by limitations imposed by the University and the government (corr=.19937, p=.0008, n=282).

5. Students who made frequent web access reported more problems with the shortage of image scanner (corr=.15312, p=.0100, n=282).

6. Students who appreciate the value of web sites in research work made more frequent access than the students who did not (corr=.15980, p=.0112, n=251).

7. Students with higher overall GPAs reported more frequent problems with outdated and old versions of software (corr=.11842, p=.0401, n=301).

9. Students with higher overall GPAs also complained more problems with free speech caused by limitations imposed the University and the government (corr=.12049, p=.0393, n=293)

10. Students with higher overall GPAs also reported more problems with search engines (corr= .12297, p=.0321, n= 304).

IMPROVING UNIVERSITY'S INTERNET SERVICES

Better Internet hardware, current software, and services are needed to improve the productivity, efficiency, success and satisfaction for student users at University. While class level does not impact the use and appreciation of web technology, frequent problems with web facility and supports seem to discourage students from accessing the web. For the problems with the use of file transfer facility, it is suggested that students should be taught how to use it. The use of file transfer utility requires students to know basic commands, file directory, and options (binary, ASCII). Wrong target directory and options could spell troubles to new students. Furthermore, students of higher GPAs seem to exceed the current capability of software and are likely to find Internet and Web software in the lab outdated. Understanding of free speech limitation imposed by the University and government could be improved by a course in Computer Ethics and Laws. While principles for effective use of application software in the work place and classrooms have been well documented, certain basic, but often overlooked, elements can and should be introduced into Internet services at University. These include improving access speed, faster network, better user training, better tools, electronic commerce capacity, better network and data security, and frequent upgrade of software. Unfortunately, many of the problems such as limitation of search engine capabilities, Web development languages, remote server overload, bugs that caused browser crashes, etc. are beyond the control of University's computing services department.

CONCLUSIONS

This study has confirmed some existing belief, suspicions, and added to some existing knowledge in Web usage in classroom. Better hardware, up-to-date software, training, and services are needed to improve the efficiency, success, learning, and satisfaction for students at St. Cloud State University. Frequent problems with web facility and supports also seem to discourage students from taking advantage of the web capabilities in learning. It is suggested that students should be well trained in Internet and Web facilities before using the University's computer labs for class assignments. Clearly, with the rapid advance in Internet and web technologies, opportunities exist in curriculum development to facilitate and enhance the learning and effectiveness of University's computer services.

REFERENCES

Bialac, Richard and Glover, Harry (1997), Paperless classroom in introductory courses, *Proceeding of the 12th Annual IAIM Conference*, 167-168.

Hong, Shugang (1997), Teaching Web Applications Development to IS Students, *Proceeding of the 12th Annual IAIM Conference*, 28-37.

Green, Kenneth C. (1997), *The Eighth National Survey of Computing and Information Technology in US Higher Education*. Encino, CA: Campus Computing.

Nelson, B. (1999), Using technology to Support Teaching and Learning Increasingly important to Colleges," *Heller Report on Educational Technology Markets*, Vol. 11, pp.1 -2

Thiele, John E., (1999), Effects of Web-based Instruction on Learning Behaviors of Undergraduate and Graduate Students, *Nursing and Health Care Perspectives*, Vol. 20, No. 4, pp. 199 - 208.

The Campus Computing Project, The Continuing Challenge of Instructional Integration and User Support, *http://www.campuscomputing.net/*, 1999.

APPENDIX

WWW Survey

All responses are anonymous and confidential.

I. *Student's background.* Please circle appropriate number or letter.

1. Your class standing: 5: Graduate, 4: Senior, 3: Junior, 2: Sophomore 1: Freshman
2. Number of times you access the Web pages per week ______________________
3. Your major GPA is about: A:3.5 -4.0, B: 3.0-3.49, C:2.5-2.99, D: 2.0-2.49, E: Below 2.0
4. Your overall GPA is about: A:3.5 -4.0, B: 3.0-3.49, C:2.5-2.99, D: 2.0-2.49, E: Below 2.0

II. *Frequencies of problems encountered in your home page development: Please circle A: Always, B:Usually C: Sometimes, D:Rarely, E: never*

5. Computer and/or network speed is slow A B C D E
6. Lack of color scanners available caused major problems A B C D E
7. Lack of good software to edit image and convert image type (ie. from JPG type file to GIF or BMP type file) A B C D E
8. Text editor on host computer (Unix) is difficult to use A B C D E
9. Text color is not flexible to be changed A B C D E
10. Language that supports interactive page such as Java or CGI is limited and difficult to use A B C D E
11. Network software is back-versioned and outdated A B C D E
12. Download new version of network access such as Netscape is difficult to connect and takes too much time A B C D E
13. Uploading/downloading text and software from PC to host computer is difficult A B C D E
14. Cannot develop or link web page that is provocative or politically incorrect (ie. problem with free speech) which cause problems in development of quality web page A B C D E

III. *Frequencies of problems encountered when accessing other web pages: Please circle A: Always, B:Usually C: Sometimes, D:Rarely, E: never*

15. Slow network connecting/transferring data from and to other hosts A B C D E
16. Computer CPU/video used in development is slow (486 CPU 33 MHz or less) A B C D E
17. Connecting modem is slow (14,400 BPS or less) A B C D E
18. Difficult to locate/find target pages (using Yahoo, Webcrawler, etc) A B C D E
19. Software is too outdated (old version) to take advantage of latest web page technology A B C D E
20. Not able to find computer that can access web pages in the computer lab when needed A B C D E
21. Web page crashes during connection/access A B C D E
22. Your evaluation of WWW services available at this university:
    A: Excellent, B: Good, C: Average, D: Below Average, C: Poor
23. Your evaluation of WWW services to help you in research paper:
    A: Excellent, B: Good, C: Average, D: Below Average, C: Poor
24. Please write below other problems that you have in using WWW pages:
    ____
    ____
25. Please write below other problems that you experienced in the development of your own home page:
    ____
    ____

TEACHING SYSTEMS ANALYSIS AND DESIGN TO A MIXED CLASS OF CS AND BIS MAJORS

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Extended Abstract

This paper presents the observations of the author in teaching Systems Analysis and Design to a combined class, comprising of Computer Science and Information Systems third year students. The findings are based on an interpretivist approach. The students from the two streams have different backgrounds, different attitudes to the course, and different involvement, which lead to different success rate in the course.

Systems Analysis and Design is one of the most important courses in the IS curriculum. At the same time there is a discussion to what extent this course should be included in the CS curriculum if at all. It must be noted however that the emphasis of the CS degree at the University of Natal, Pietermritzburg is more on the practical concepts, bringing it closer to some Software Engineering programmes.

CLASS BACKGROUND

The class consists of 53 students, 25 majoring in Computer Science, and 28 majoring in Business Information systems. The major in Computer Science is offered by the Faculty of Science. All CS students have a strong background in Mathematics, Statistics and Programming. The major in Business Information Systems is offered in the School of Business and all students have a good background in Economics, Management, Accounting, and good understanding and exposure to the business practices. They have relatively good exposure to programming. The course includes 26 lectures, seven tutorials, and four three-hour practicals in the computer lab.

The two groups have different attitudes towards the course, according to the questionnaire filled by the students at the beginning of the semester. The CS students consider the course as an intrusion to the CS curriculum. This is a worrying indicator showing a culture being promoted by the rest of the modules in CS. The BIS group has high expectations about the subject, which is seen as the one that will bring them closer to their future working practices.

BRIEF DESCRIPTION OF SOME ASPECTS OF THE COURSE

Lectures

One of the intentions of the lecturer in this course was to create an interactive discussion atmosphere during lecture time.

Case Studies

The use of case studies was one of the tactics often used in this course. Many CS students felt uncomfortable to be left without clear one dimensional model answers, being used to single solution answers within their science background. Multiple views, as an opinion concept, was not known to them.

Literature Survey

The first of the two projects was a literature survey on different topics related to Systems Analysis and Design. The groups had a choice of topics as Information

Engineering, Business Process Reengineering, Joint Application Development, Prototyping etc. During the three years of study this was the first textual assignment for the CS students. It was also the first oral presentation for most of the Science students and it was met with a lot of anxiety.

Analysis and Design of a Business Information System

This was the second assignment which revealed further differences between the two streams but to a lesser extent than at the beginning of the course.

The paper expands on the above issues. It relates the tasks of the course to the typical outcomes within the most recent approved IS curricula by ACM, DPMA and other bodies. It compares the content of the course with the requirements of published Software Engineering and Computer Science curricula. In conclusion the paper identifies directions for further work to improve this course towards being a foundation for creating systems developers able to design complex information systems no matter what their original background and limitations could be.

COMPARING THE IMPORTANCE OF IT JOB SKILLS IN AUSTRALIA AND THE UNITED STATES

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ABSTRACT

Information technology (IT) educators face the two converging trends of globalization and IT human resource scarcity. These two trends challenge IT educators to understand how skill requirements differ in the global economy. In an attempt to facilitate this understanding, the study reported here investigates the question of how the skill requirements for recent IT graduates vary across two countries; Australia and the United States. Employers in each country were surveyed to determine the importance they place on various skills when evaluating entry-level IT employees. Results indicate that there are a number of similarities across the two countries. However, further analysis reveals that while the relative importance of various categories of skills are similar across the countries, the magnitude of differences in the mean ratings of various skill categories differs. The differences in mean ratings tend to be more significant in Australia than in the United States. The results of this study hold implications for both employers and IT educators.

INTRODUCTION

As information technology (IT) progresses into the 21st century, two trends that are converging hold particular importance for IT educators. First, information systems are becoming increasingly global in nature. In fact, it has been stated that global information systems are now more the norm than the exception (Collins, 1996). Second, satisfying the demand for properly skilled IT professionals is increasingly difficult. When combined, these trends represent an important challenge for IT educators—how to provide IT program graduates who posses the skills necessary to succeed in today's global environment.

In order to take a step toward helping educators meet this challenge, this paper abstracts an ongoing research project that compares the importance employers in Australia and the United States place on various IT-related skills when evaluating entry-level IT employees. The results of the completed research may 1) help educators better understand IT employers' requirements for entry-level IT human resources, 2) help IT practitioners gain insight into differences in employment environments that may affect their global IT teams, and 3) provide IT students who wish to pursue global opportunities with information on how skill requirements may vary between countries.

PURPOSE OF THE STUDY

The purpose of the research-in-progress described here is to identify and understand differences and similarities in the importance of various skills as viewed by employers of entry-level IT professionals in Australia and the United States. While the literature includes a number of studies that focus on IT-related skills (e.g. Cheney, et al., 1990; Leitheiser, 1992; Lee et al., 1995; Nord & Nord, 1995; Athey & Wickham, 1995-1996; Van Slyke et al., 1998), there has been little attention paid to two particular aspects of IT-related skills, 1) the importance of skills for entry-level positions and 2) comparisons of skill importance across countries. The research described here addresses both of these neglected areas by comparing the perspectives of Australian and North American employers' perceptions of the importance of various IT-related skills.

METHODOLOGY

A survey was administered to employers of recent graduates of university IT program in two countries, Australia and the United States. Subjects consist of individuals involved in the recruiting of entry-level IT professionals. Note that the respondents are diverse with respect to the size of the organization they represent, the geographic location of the organization, and the industry in which the organization operates. While this does not guarantee a truly random sample of all IT employers, it should provide for a sample that is representative of the population of IT employers in Australia and the United States. To date 25 Australian and 33 United States responses have been received.

The development of the survey instrument is reported in Van Slyke, Kittner and Cheney (1998). Briefly, the survey presents a number of skills and asks subjects to rate how important each skill is when evaluating applicants for entry-level IT positions where a Bachelors degree is required. The rating is done on a scale of 1 (not important) to 5 (critical). In addition, subjects are encouraged to add skills to the list. Skills were categorized by a number of IT professionals, and these categories were used to group the skills on the questionnaire. The categories are shown in Table 1 along with a number of examples of skills from each category. Note that the example skills are non-exhaustive. They are simply intended to provide the reader with sense of the skill category.

RESULTS

Analysis of the surveys received to date indicate that there is general agreement in the ratings given to the various skill categories. With one exception, there were no statistically significant differences in the category mean ratings between the Australia and United States respondents. Table 1 shows the mean rankings and standard deviations for each skill category by country. In addition, significance levels (p) are given.

As can be seen from Table 2, employers in Australia and the United States seem to view the importance of skills similarly. With only one exception (Non-technical skills), there are no statistically significant differences between the category mean ratings of employers in Australia and those in the United States.

Interestingly, the only skill category to show a significant difference in the mean ratings was Non-technical skills. There is general agreement in the literature that non-technical skills are very important to IT professionals. Further, in both countries, employers place more importance on non-technical skills than they do on any category of technical skills, which confirms the results of the prior studies. It is also interesting to note that there was general agreement among the respondents within each country as to the importance of non-technical skills. The standard deviations for both countries are relatively low. In fact, the Non-technical category had the smallest standard deviation for the United States respondents. The results related to the Non-technical skills category may be interpreted to mean that although employers in both countries feel that non-technical skills are very important in evaluating new IT graduates, the Australian employers find these skills to be less important than do employers in the United States.

In attempting to understand the results it is interesting to look at the absolute differences in ratings for the two sets of employers. In most cases, not only were there no differences of statistical significance, there were only very small differences in terms of absolute ratings, which are shown in Table 3. The mean ratings of only two categories, Operating Systems, and Non-technical skills, differed by more than 0.50 (on a five-point scale). This tends to indicate that, in general, employers in the two countries feel similarly about the importance of different categories of skills.

TABLE 1
SKILL CATEGORIES AND EXAMPLES

Category	Example skills
General information systems	Systems analysis and design Database concepts Prototyping Telecommunications
Programming languages	COBOL C++ Visual Basic Java
Operating systems	Unix Windows 95/98/2000 JCL VMS
Networking	NT Server Novell Netware TCP/IP System security
Database management systems	DB2 Oracle Microsoft Access SQL
Other information systems skills	EDI PC applications Lotus Notes AI development
Business skills	Understand business functional areas User interviewing Feasibility analysis Project management
General skills	Analytical ability Verbal communication Written communication Teamwork

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TABLE 2
RESULTS BY SKILL CATEGORY

Category	Australia Mean	Australia Std. Dev.	U.S. Mean	U.S. Std.Dev.	Significance
General IS	3.42	0.57	3.58	1.18	0.533
Programming Languages	2.76	0.95	2.86	1.44	0.763
Operating Systems	2.54	1.23	3.09	1.50	0.138
Networking	3.46	0.42	3.70	1.10	0.702
Non-technical	4.16	0.45	4.73	0.71	< 0.001
Business-Related	3.17	0.29	3.40	1.17	0.341

TABLE 3
ABSOLUTE DIFFERENCES IN MEAN RATINGS

Category	Australia Mean	U.S. Mean	Difference
General IS	3.42	3.58	-0.160
Programming Languages	2.76	2.86	-0.100
Operating Systems	2.54	3.09	-0.550
Networking	3.46	3.70	-0.240
Non-technical	4.16	4.73	-0.570
Business-Related	3.17	3.40	-0.230

Results for the two countries are also similar in the relative importance of each skill category. Table 4 shows the ranking of each skill category from most important to least important as measured by the category mean. For convenience, the mean rating is given in parentheses.

Once again, the results are similar for both countries. The top four rankings are the same for Australia and the United States. However, the rakings in the two last spots are reversed, with Australia showing Programming Languages in the fifth position and Operating Systems sixth, and the opposite for the United States.

In order to gain insight into the relative importance of the different skill groups, a series of t tests were performed that tested for significant differences between the mean ratings of pairs of skill categories for each country. The categories were paired based on the relative rankings shown in Table 4. For example, the Australian mean rating of skills in the Non-technical category was tested against the mean rating for the Networking category. Table 5 provides the results of these tests.

Examination of Table 5 provides some interesting contrasts between the results from the two countries. In both countries, there is a highly significant difference between the Non-technical and Networking categories. The results for each country are also similar for Networking vs. General IS, which is non-significant. However, differences in the results for the two countries emerge further down the list. For the Australia group, there is a borderline significant difference in the General IS and Business-Related ratings, while the difference between the categories is highly non-significant for the United States group. In order to be more complete in the analysis, an additional t-test was performed to test whether the United States Business-Related and Operating Systems mean ratings were different. The test reveals borderline significance ($p = 0.082$). This is somewhat similar to the Australian result, which indicates that there is a significant difference in the mean ratings of these two categories ($p = 0.045$). Neither country displayed a significant difference in the mean ratings of the Programming Languages and Operating Systems categories.

TABLE 4
SKILL CATEGORY RANKINGS

Rank	Australia	United States
1	Non-technical (4.16)	Non-technical (4.73)
2	Networking (3.46)	Networking (3.70)
3	General IS (3.42)	General IS (3.58)
4	Business-Related (3.17)	Business-Related (3.40)
5	Programming Languages (2.76)	Operating Systems (3.09)
6	Operating Systems (2.54)	Programming Languages (2.86)

TABLE 5
INTER-CATEGORY TESTS

Australia	Significance	United States	Significance
Non-Technical vs. Networking	< 0.001	Non-Technical vs. Networking	< 0.001
Networking vs. General IS	0.826	Networking vs. General IS	0.671
General IS vs. Business-Related	0.057	General IS vs. Business-related	0.536
Business-Related vs. Programming Languages	0.045	Business-related vs. Operating Systems	0.353
Programming Languages vs. Operating Systems	0.483	Programming Languages vs. Operating Systems	0.527

CONCLUSIONS

Before discussing any conclusions that can be drawn from the results of this study, it is important to note that the results reported here are preliminary and are based on relatively small samples. Care should be taken when basing actions on these results. Additional research is necessary in order draw strong conclusions.

It is clear that according to the results of this study employers in both countries seek IT graduates with solid non-technical skills. In both Australia and the United States, the Non-technical category had the highest mean ratings. Further, in both countries, the differences in the mean ratings of Non-technical skills and those of the next highest-rated category (Networking) are highly significant. The message from employers is that non-technical skills are critical, regardless of the country. This result lends credence to earlier, single-country studies that found "soft" skills to be very important to success in the IT world. Our findings indicate that the importance of these skills is not limited to a single country. Further, these skills not only are important to the success of IT professionals, they are critical to entry into the field.

Regardless of the perspective, significant differences, absolute differences, or relative rankings, it seems reasonable to conclude that there are a number of similarities in what employers in both countries desire from entry-level IT professionals. In both Australia and the United States, non-technical skills are highly sought after, as are networking and general information systems skills. Programming skills and operating systems-related skills are much less important when evaluating entry-level IT professionals in both countries.

It is important to recall, however, that despite the similarities in the results from the two countries, it would be incorrect to state that the employers in Australia and the United States view the importance of various skills exactly the same way. The analysis of inter-category differences (see Table 5) reveals that there are more pronounced differences in the mean category ratings in Australia than in the United States.

As information systems become more global in scope, IT project managers should take heart from the results of this study. Employers in two distant countries view the importance of skills similarly. This bodes well for project managers who must deal with IT professionals of different nationalities. If the perceptions of those who employ IT graduates influence the educational programs that create the graduates, there will be similarities in the skill sets of graduates from Australia and the United States. The similar skills sets should make managing human resources in global IT projects easier.

In addition, there are implications for educators. It seems that the desires of employers are somewhat homogenous across countries. This may mean that educators in different countries who wish to have their students interact should be able to develop programs that meet the needs of employers in multiple countries. The similarities may also make it easier to design educational programs that allow students to spend time in other countries, without fear of failing to meet the needs of employers in the home country. For example, Australian students who spend time studying in the United States would find that the importance of the skills gained in the experience would be viewed similarly by Australian employees. Of course, this assumes that there is correspondence between employers' desires and curricula.

Painting a comprehensive picture of how the importance of skills varies across countries requires considerable further effort. A wider sample of employers in both subject countries needs to be surveyed. In addition, additional countries should be studied to find whether the results found in this study hold. Finally, surveys are limited in the depth of understanding they can provide. Interviews with employers (which are currently being conducted as part of this study) may provide deeper insights into the meaning of the results reported here.

ACKNOWLEDGEMENT

The authors would like to acknowledge and sincerely thank Dr. Sharon Wong for her invaluable assistance in this project.

REFERENCES

Athey, S. & Wickham, M. (1995-1996). Required skills for information systems jobs in Australia. *Journal of Computer Information Systems*, 36(2), 60-63.

Cheney, P., Hale, D. & Kasper, G. (1990). Knowledge, skills and abilities of information systems professionals: Past, present and future. *Information & Management*, 19(4), 237-247.

Collins, R. (1996). Global information systems and the World Wide Web. *Journal of Global Information Systems*, 4(3), 3-4.

Lee, D., Trauth, E. & Farwell, D. (1995). Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation. *MIS Quarterly*, 19(3), 313-340.

Leitheiser, R. (1992). MIS skills for the 1990's: A survey of MIS managers perceptions, *Journal of Management Information Systems*. 9(1), 69-91.

Nord, G. & Nord, J. (1995). Knowledge and skill requirements important for success as a systems analyst. *Journal of Information Technology Management*, 6(3), 47-52.

Van Slyke, C., Kittner, M. & Cheney, P. (1998). Skill requirements for entry-level IS graduates: A report from industry. *Journal of Information Systems Education*, 9(3), 7-11.

AN EXPLORATORY STUDY OF THE FACTORS CONTRIBUTING TO MIS STUDENT ORGANIZATION EFFECTIVENESS

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ABSTRACT

Student MIS organizations can be a valuable asset in achieving the goals of a university's MIS program. In this preliminary investigation, we surveyed student MIS organizations using the Doty, et al, measures of organizational effectiveness. Thirteen valid surveys were returned and the web sites of those student organizations were content analyzed. The analysis revealed that successful student organization websites implemented these structural components: mission statement, online link to University Career Center, online event calendar, online list of officers and committees, online membership application, and online social event announcements.

INTRODUCTION

Discipline-related student organizations have long been valued by Schools and Colleges of Business as a vehicle to broaden student experiences. Student chapters of national professional organizations in accounting (Institute of Management Accountants), operations management (American Production Inventory Control Society), marketing (American Marketing Association), and many others thrive on college campuses around the country. However, there does not appear to be a like professional organization in Information Systems with a significant number of student chapters.

Although there may not be a national umbrella professional organization with which many MIS student organizations have chosen to affiliate, our research indicates that many MIS programs have established MIS student organizations. Because these organizations are largely unaffiliated, there is little standardization from organization to organization. Each MIS student organization, therefore, chooses which activities it undertakes, the level of formal structure of the organization, and the types of goals it pursues. Undoubtedly, some organizations are more successful than others. We postulate that an understanding of the factors that contribute to successful organizations can

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lead to a framework for an organizational structure and an activities set that will lead to improved MIS student organization effectiveness.

The purpose of this research is to determine a framework for success in MIS student organizations and to identify those factors which can most positively contribute to that success. We examine the structures and activities of successful MIS student organizations to identify best practices. These best practices are assembled into a comprehensive organizational structure and activities set that lends standardization to the organization and improves organizational effectiveness.

REVIEW OF LITERATURE

A review of the literature on student organizations and learning was performed to determine what is formally known about the relationship between student organization activities and student learning. Educators have proposed a number of learning models, including collaborative learning, cognitive information processing, and sociocultural learning [Leidner and Jarvenpaa, 1995]. These learning models are not necessarily exclusive they can be alternated or offered in conjunction with one another. It would appear that well-grounded student organization can promote learning through each of these models. A student IS organization performs an important function to a successful IS program. Student organizations are a valuable supplement to the learning a student acquires with the standard IS curriculum. A MIS student organization can promote, among other things, learning about current IS practices and professional ethics.

Money (1994) has proposed that universities should explore new channels of product delivery off-site courses, e-education, etc. However, the research article also calls for broadening students' educational experience and speaks of the "content-based dangers of IS curriculum because of limited linkages between Universities and practitioners' worlds (p.50), citing the work of Spruell and Franz (1993). Argyris (1990) theorizes that support for the educational experience of the student is needed beyond the classroom and program of course work. Each of these papers supports the broadening of educational experience through cooperative experiences, internships, field trips, guest speakers, and, by implication, student organizations.

Cale (1994) provides an example of a very intense broadening and deepening linkage between the University and practitioner world through student work with a mentor company an activity that could be supported through a MIS student organization. Fry (1993) also makes a case for tight linkage between education and industry. This work describes successes from a cooperative curriculum development program partnering academics and industry representatives. An industry advisory board for a MIS student organization would appear to be in sync with this approach. Jacobs (1995) discusses the role of an Advisory Board and how it can tighten linkages between academics and university including providing speakers to students.

Pierce and Henry (1994) found a difference between how educators and IS professionals perceive ethical issues, practices, abuse opportunities, extent of abuse, etc. One example of these differences is that professionals see ethical issues arising more frequently than do academics (i.e., more of a real world problem). Because of these differences, educators may not be teaching ethics as knowledgeably as it could be taught. The authors conclude that, since teaching ethics is not easy (especially given that academics and IS practitioners have different perceptions), it is important that educators and professionals form a partnership. Student organizations can provide an opportunity to foster this partnership.

Dick, et al. (1995) suggest colloquium evenings and short seminars as appropriate vehicles to deliver an understanding of professional ethical expectations, the role of IS professionals, negotiation skills, and where an IS career might lead. Benbasat et al. (1980) have noted that too much emphasis has traditionally been placed on developing students' technical skills and not enough on behavioral or organization skills. The aforementioned colloquia and short seminars are one means of increasing behavioral and organizational skills. Student organizations would appear to be an ideal platform for reinforcing students' understanding of these critical skills.

Dick, et al. (1995) have reviewed the literature on learning strategies, including action learning, workplace learning, etc. Hughes and McLean (1992) have surveyed literature on many of these learning strategies. Dick sees workplace learning as especially relevant to cooperative education. Dick notes that there is an important distinction between workplace learning and workplace training: workplace learning emphasizes organizational and behavioral skills, and that the emphasis is on the learner rather than the teacher. Many student organization activities, if approached correctly, can lead to these types of learning.

One informal method of workplace learning is dialogic learning learning through informal discussions with other workers. Gardiner & Singh (91) have found that cooperative education programs in Science and IS result in students whose transition to the workplace is less difficult than their (non-coop) peers. Cooperative education is a strategy of applied learning which is structural, developed, and supervised by a university in collaboration with one or more employing organizations. The philosophy underlying cooperative education is closely aligned with the experiential learning strategy (Galliers, 1987; Lee 1987; Little and Magetson, 1989; and Wersky, 1989). Small, et al. (1998) have found that cooperatives can provide another avenue for students to engage in experiential learning, including through community service projects. While lacking the depth of cooperative education, student organization professional activities can increase the breadth of experiential activities.

Pierce and Henry (1994) have concluded that it is important to instill ethical standards in IS students. A role of the MIS student organization can be to promote professional ethics.

Romm and Wong (1997) have found that the best method to teach soft skills is through case study. Cragg (1998) found that site visits serve as a form of live case study on IS courses. The site visit brings reality to the students and provides variety in the learning experience while encouraging action learning. Further, the author contends that a site visit allows for a rich opportunity for students to explore theory and practice, expose students with little experience to the complexities of organizations, and help educators to keep up to date with current practices and problems. Many student organizations organize visits to industry sites.

Summary

We found a substantial body of literature indicating that many of the activities that student organizations can undertake have a positive effect on student learning. It would appear that activities such as seminars, colloquia, speaker visits, visits to industry sites, promotion of professional ethical standards, and collaboration with advisory boards enrich and broaden the student learning experience. This study attempts to determine the scope and frequency of such activities in today's successful MIS student organizations so as to establish a framework of best practices. Such a framework should allow student organizations from across the country to assess the effectiveness of their organization and to identify additional activities that the organization can pursue to be more successful.

METHOD

This study was carried out in phases. First, the literature on student organizations and learning was reviewed to determine what is formally known about the relationship between student organizations and student learning. Second, a search of the Internet was conducted in an attempt to find a representative sample of convenience of MIS student organizations (see Appendix A). Thirty organizations were identified and included in the study.

In the third phase of the study, representatives (student officers or faculty advisors) from these organizations were contacted via email and asked to respond to a one-page survey (Appendix B) on organizational effectiveness. The representatives were given a choice of responding either through a website devoted to collection of the survey responses or by email reply. The survey instrument is adapted from the Doty, et al. seminal research on organizational effectiveness measures and has been shown to provide a reliable and valid metric. The purpose of the survey was to determine which of the sample organizations are most effective.

Representatives from thirteen organizations (43%) responded to our email request. Once the survey responses were received, each organization's score was tabulated. The highest-scoring responders were considered the most successful student IS organizations. Once the most successful MIS student organizations were identified from the sample, the web sites of these organizations were content analyzed to determine their organizational structure and to identify the activities that are conducted by the organization.

The resulting analysis produced a listing of structural components and activity components, which represents the collective structural types and activities set of the successful organizations. From these lists, the researchers constructed a framework for the model organization that is consistent with current theory on extracurricular learning as identified in the literature review.

RESULTS

In response to the e-mail solicitation, completed surveys were received from thirteen organizations. These have been coded and organized by total scores, which are summarized at the top of the Table 1. The leftmost case had the highest score and the rightmost, the lowest. Individual item responses are listed by scale and item ID. Questions 4 through 7, not being derived from a previously validated scale, were not used in computing rankings. Future studies with larger samples may examine correlation of these items with validated scales.

Content analysis of the six highest rated organization's websites is summarized in Table 2. The features most commonly found at the highly ranked student organizations' websites are listed toward the top of the chart.

TABLE 1
SURVEY RESPONSE DATA

Case #	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Years	2	4	1	2	1	1	2	0	2	2	1	5	3
Scale1	4.4	4	4.2	3.8	4	4	3.6	3.6	3.6	3.4	3	2.8	2.4
Scale2	4.4	5	4.2	4.2	3.6	3.6	3.4	3.4	3.4	3	3.2	2.4	2.2
Scale3	5	5	5	0	4	3.6	0	0	0	3.6	0	0	2.2
Wt_Avg	4.55	4.5	4.4	4	3.9	3.8	3.5	3.5	3.5	3.35	3.1	2.6	2.3
Z Score	0.138	0.125	0.100	0.000	-0.025	-0.050	-0.125	-0.125	-0.125	-0.163	-0.225	-0.350	-0.425
Rank	1	2	3	4	5	6	9	8	7	10	11	12	13
Q1-a	3	5	4	3	4	4	4	3	3	4	2	3	2
Q1-b	5	4	5	4	4	5	4	4	4	4	5	4	3
Q1-c	4	3	4	3	3	3	3	3	3	3	2	2	2
Q1-d	5	4	4	4	4	4	4	4	4	3	3	3	2
Q1-e	5	4	4	5	5	4	3	4	4	3	3	2	3
Q2-a	3	5	4	5	4	4	4	3	3	3	3	3	3
Q2-b	5	5	5	5	3	4	4	4	4	3	5	4	2
Q2-c	4	5	4	3	3	3	3	3	3	3	3	2	2
Q2-d	5	5	4	4	3	4	4	4	4	3	3	3	2
Q2-e	5	5	4	4	5	3	2	3	3	3	2	0	2
Q3-a	5	5	5	0	6	4	0	0	0	4	0	0	3
Q3-b	5	5	5	0	3	4	0	0	0	4	0	0	2
Q3-c	5	5	5	0	3	3	0	0	0	3	0	0	2
Q3-d	5	5	5	0	3	4	0	0	0	3	0	0	2
Q3-e	5	5	5	0	5	3	0	0	0	4	0	0	2
Q4	5	3	5	5	5	4	4	4	4	4	4	4	1
Q5	5	3	4	4	4	2	4	3	4	5	5	4	1
Q6	5	5	5	4	5	4	5	4	3	5	5	4	1
Q7	5	3	5	3	3	4	4	3	3	3	4	4	1
Natorg*	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y

TABLE 2
ACTIVITIES OF THE HIGHEST-RATED ORGANIZATIONS

Case Number->	1	2	3	4	5	6
Feature (Instances)						
Mission Statement (6)	X	X	X	X	X	X
Link to University Career Center (5)	X		X	X	X	X
Event Calendar (5)	X		X	X	X	X
Officer / Committee Listings (4)	X	X	X	X	X	
Job Listings (4)	X		X		X	X
On Line Membership Application (4)	X	X		X	X	
Social Event Announcements (4)	X		X		X	X
Corporate Sponsor Acknowledgement / Links (3)	X		X	X		
Link to MIS Department (3)	X		X	X		
Current News or “What's New (3)	X		X	X		
On-Line Resumes (3)	X		X	X		
Links Page General Interest (3)			X	X		X
Links to Global (non- university specific) Job Search Tools (3)				X		
Links to Tutorials and Research Aids (3)		X	X	X		
Automated e-mails to Members (3)				X	X	X
Speakers from Off-Campus (3)	X		X		X	
Alumnae Database / Links (2)	X		X			
Internal Discussion Groups/ Bulletin Boards (2)	X				X	
Links to Other Campus Resources (2)			X	X		
Links to University News (2)				X		X
Multimedia Intro (2)			X		X	
Links to Affiliate Sites (2)					X	X
Speakers from Campus (2)			X		X	
Trips / Site Visits (2)	X		X			
Recruiter Postings-Externally Updateable (1)	X					
Links to Member Home Pages (1)		X				
On-Line Help for Using Site (1)		X				
Meeting Minutes (1)				X		
Activity Pictures (1)					X	
President's Message (1)					X	
Interest Groups / Learning Groups (1)					X	
Constitution / Bylaws (1)			X			

CONCLUSIONS

The results from the study indicate that the most effective IS student organizations carry out activities that are consistent with the student learning activities that have been identified in our literature review. Many of these relate to future employment opportunities and are intended to foster closer contact between the student members and business and industry. Each of the successful organizations has a mission statement. Most have an active relationship with the institution's Career Center and keep student members informed of upcoming activities through an online calendar. While most organizations publicized their officer's contact information, each organization offered an entirely different set of club-related activities.

Based upon the sample results, we recommend that a student IS organization consider implementing the following structural components:

Mission Statement;
Online link to University Career Center;
Online event calendar;
Online list of Officers and committees;
Online membership application; and
Online social event announcements.

In addition, we recommend that a student IS organization plan, organize, and carry out many activities each year. These activities include:

Develop and post an online resume book;
Provide links to general and job-specific search tools;
Provide links to tutorials and research aids;
Provide automated email to members through the organization website;
Host speakers from off-campus.

Each of the most successful student IS organizations identified as part of this study had an extensive and robust activities set that serves to keep members involved and enthused. In addition, each organization appeared to have made a substantive effort to open communication channels amongst its members and with the larger business community. These philosophies, along with the structural and activities components suggested here, should improve the effectiveness of any IS student organization.

REFERENCES

Argyris, C. (1990). *Overcoming Organizational Defenses.* Boston: Allyn and Bacon.

Benbasat, I., Dexter, A. S., and Mantha, R. W. (1980). Impact of Organizational Maturity on Information System Skill Needs. *MIS Quarterly*, 4(1): 21-34.

Cale, E. G., Jr. (1994). Teaching Information Systems in a Functionally Integrated MBA Program, *Proceedings of the International Academy for Information Management*, Las Vegas Nevada, December 2-4: 87-94.

Cragg, P. B. (1998). Site Visits as a Teaching Method in Information Systems Courses. *Proceedings of the International Academy for Information Management*, Helsinki Finland, December 11-13: 153-160.

Dick, G. N. and Jones, S. F. (1995). Exposure to Workplace Issues While at University: Giving Students an Edge. *Proceedings of the International Academy for Information Management*, New Orleans Louisiana, December 15-17: 110-120.

Doty, D., Glick, W., and Huber, G. (1993). Fit, Equifinality, and Organizational Effectiveness: A Test of Two Configurational Theories. *Academy of Management Journal*, 36:6, 1196-1250.

Fry, M. (1993). Information Systems Curriculum Development to Meet Industry Needs. *Journal of Education for MIS*, 1(1), 5-10.

Galliers, R. D. (1987). Educating Information Systems Managers into the 1990s: The WAIT Example, in Buckingham, Hirscheim, Land & Tully, *Information Systems Education: Recommendations and Implementations.* Cambridge: Cambridge University Press, 166-178.

Gardiner, R., and Singh, P. (1991). *Learning Contexts of University and Work: An Evaluation of the Effectiveness of Co-operative Education as a Skills Enhancement Process.* Canberra: Australian Government Printing Service.

Hughes, C., and McLean, J. (1992). *Learning Through Co-operative Education: A Literature Search.* The IPACE Institute, Unisearch Ltd. UNSW.

Jacobs, N. W. (1995). Reflections on the First 10 years of an IS Advisory Council: A Case Study. *Proceedings of the International Academy for Information Management*, New Orleans Louisiana, December 15-17: 215-218.

Lee, B. S. (1987). *Teaching Methods and Sandwich Courses, in Buckingham, Hirscheim, Land & Tully, Information Systems Education: Recommendations and Implementations.* Cambridge: Cambridge University Press, 215-223.

Leidner, D., and Jarvenpaa, S. L. (1995). The Use of InformationTechnology to Enhance Management School Education: Case Studies on Electronic Classrooms. *Information Systems Research*, 4(1), March, 24-54.

Little, S. E. and Margetson, D. B. (1989). A Project-Based Approach to Information Systems Design for Undergraduates, *Australian Computer Journal*, 21(2), 130-137.

Money, W. H. (1994). Understanding the Importance of Fully Developing the Channels for the Delivery of Management Information Systems Education. *Proceedings of the International Academy for Information Management*, Las Vegas Nevada, December 2-4: 49-62.

Pierce, A. P., Henry, J. W. (1994). Computer Ethics: The Environments of CS/IS Educators and Practicing Computer Professionals. *Proceedings of the International Academy for Information Management*, Las Vegas Nevada, December 2-4: 179-189.

Romm, C. T. and Wong, J. (1997). Internationalising the MBA Core in MIS An Interactive, Integrative Approach. *International Conference on Decision Sciences.* Macquarie University, Sydney, Australia, July 20-23.

Small, R. V., Venkatesh, M., and Marsden, J. (1998). The Education of IT Professionals: Integrating Experiential Learning and Community Service. *Proceedings of the International Academy for Information Management*, Helsinki Finland, December 11-13: 161-171.

Spruell, J., & Franz, M. (1993). Enhancing MIS Education with the Professional Development Program. *Proceedings of the International Academy for Information Management*, Orlando Florida, December 3-5: 171-182.

Werskey, G. (1989). Co-operative Education in Information Systems. Stage One of a Long-Term Human Resources Strategy for IT-Oriented Organisations. *Proceedings SOST*, Australian Computer Society, May: 485-491.

APPENDIX A
RESULTS FROM WEB SITE SEARCH

These URLs indicate the web sites that were identified and used in the search:

http://www.mis.iastate.edu/
http://misclub.hawaii.edu/
http://www.cob.sjsu.edu/assoc/misclub/
http://www.cob.sjsu.edu/misclub/
http://www.biz.uiowa.edu/studorgs/misa/
http://snail.bpa.arizona.edu/~misga/
http://www.cba.uga.edu/smis/
http://www.uidaho.edu/~misclub/
http://www.hbg.psu.edu/clubs/mis/
http://www.uwosh.edu/home_pages/colleges/coba/Academics/majors/mis/mis-club.htm
http://octavius.coba.uwosh.edu/mis_club/
http://www.rowan.edu/mars/clubs/mis/
http://sbe.d.umn.edu/misclub/
http://www.bus.orst.edu/students/std_org/sim/what.htm
http://www.uwec.edu/Student/SIM/
http://www.sacmisa.com/home/
http://missa.dhs.org/
http://www.clubs.psu.edu/misclub/
http://www.sba.oakland.edu/misclub/
http://www.udayton.edu/~misclub/
http://www.slu.edu/organizations/mis/
http://www.umsl.edu/business/mis/mis_club.html.l
http://www.umsl.edu/studentlife/misclub/
http://www-cob.csuchico.edu/missociety/spring2000/
http://www.csun.edu/misa/
http://www.cob.fsu.edu/students/orgs/mis/
http://www.uwm.edu/StudentOrg/AITP/
http://mis.njit.edu/
http://www.bus.ucf.edu/cgi-bin/redirect/redirect.pl?http://www.bus.ucf.edu/misa/

APPENDIX B
IS STUDENT ORGANIZATION SURVEY

We are conducting research into student organizations in the Information Systems field. Please help us conduct the research by filling out the following survey - either by reply email (the survey is enclosed below) or by going directly to the research survey web site at: http://misnt.indstate.edu/isorg.htm Please answer each of the questions/items to the best of your ability. Thank you for your assistance!

Your organization's name: __________________________ College/University: ____________________________
Your position with the organization: President __ Faculty Sponsor __ Other (describe) ______________________
How long have you been associated with the organization? _____ years

1. Compared to what you would like it to be, the...	Low Medium High	Don't Know
a. time and effort required of the membership to produce your organization's services to students is	1---2---3---4---5---6---7	9
b. quality of your organization's services to students is	1---2---3---4---5---6---7	9
c. involvement per member in your organization is	1---2---3---4---5---6---7	9
d. satisfaction of most members with the organization is	1---2---3---4---5---6---7	9
e. effectiveness of communications among your organization's committees and the membership is	1---2---3---4---5---6---7	9

2. Compared to other student organizations at your school, the...	Low Medium High	Don't Know
a. time and effort required of the membership to produce your organization's services to students is	1---2---3---4---5---6---7	9
b. quality of your organization's services to students is	1---2---3---4---5---6---7	9
c. involvement per member in your organization is	1---2---3---4---5---6---7	9
d. satisfaction of most members with the organization is	1---2---3---4---5---6---7	9
f. effectiveness of communications among your organization's committees and the membership is	1---2---3---4---5---6---7	9

3. Compared to IS student organizations at other schools, the...	Low Medium High	Don't Know
a. time and effort required of the membership to produce your organization's services to students is	1---2---3---4---5---6---7	9
b. quality of your organization's services to students is	1---2---3---4---5---6---7	9
c. involvement per member in your organization is	1---2---3---4---5---6---7	9
d. satisfaction of most members with the organization is	1---2---3---4---5---6---7	9
g. effectiveness of communications among your organization's committees and the membership is	1---2---3---4---5---6---7	9

Rate your agreement to the following:

	Strongly Disagree Neutral Strongly Agree
Our student organization does a very good job in reaching our goals.	1---2---3---4---5---6---7
Our student organization has grown at the same rate or faster than the rate of new students in the IS area at our school.	1---2---3---4---5---6---7
Our organization has promoted student learning in the field of IS.	1---2---3---4---5---6---7
Our organization is seen as one of the premier organizations on campus.	1---2---3---4---5---6---7

Approximately, how many members currently belong to your organization? _____ members
Would you like to see your student organization become a local chapter of a national student MIS organization? Y N

Please use the space below to provide us with any other comments you would care to make:

"SEAMLESS" OR "INFO-MEDIATED" ELECTRONIC MARKETPLACES: A RESEARCH NOTE

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Andrew Korac-Kakabadse
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The expected "Dis-Inter-Mediation" of electronic markets has not yet occurred. To the contrary, E-business technologies have created a "Re-Inter-Mediation ofMarkets". Whether a least-cost-driven management failure or a significant software deficiency, this current reality needs to be critically assessed.

The biggest current impediment to E-business is that IT-connectivity is remarkably "dumb" about recognizing context—Web searches result in unwanted and overloaded information. A paradigm shift in the development of the information highway calls for "clever" connectivity overcoming current limitations of hypertext and other Internet make-up languages.

Whether such cleverness is a software issue or a result of the growth of a new info-mediary industry, is an issue of some conjecture. This paper explores the emerging contours of an info-mediary industry and suggests that much is to be done in order to render IT-connectivity genuinely clever, genuinely inter-connected - capacities crucial to an effective knowledge-based economy.

INTRODUCTION

In the era of widespread economic and technological change, understanding the changing nature of work is important to understanding organization and re-organization (Barley, 1996). The adoption of new IT also conveys a powerful cultural load, having the capacity to involve all organizational actors in its use and being inserted into organizational life in both material and discursive ways (Webster and Robins, 1986; Hill, 1988; Muetzelfeldt, 1988; Korac-Boisvert, 1992). Materially, IT provides the potential for a wide range of data collection, storage and processing. IT provides information on demand, builds banks of shared knowledge and enables real-time, structured learning events to transcend boundaries of time and space - becoming a tool for building solutions (McAteer, 1994: 68).

IT's discursive presence is most prominent in a cultural setting concerned with the future of work and organization (Forester, 1985; 1989; Roszak, 1986; Webster and Robins, 1986). Within a sociological context, IT influences social system continuity; control; identity; and the integration of members. For example, the micro-electronic advancements of the last decade have been particularly influential on labour organizations. The use of job clustering is often facilitated by the use of IT, as opposed to job simplification, emphasized by the Taylorist influence (Hammer and Champy, 1993: 51-52).

Furthermore, when assisted by direct access to centrally-formed databanks, by means of computer networks and other forms of inter-active IT, employees at the lower levels of an organizational structure have the potential to become multi-skilled; equipped with the kind of planning and logistical information hitherto held only at the disposal of middle-managers. The distribution of the power within the work force, however, is not pre-determined (Child, 1987).

During the 1980s, the cost of IT's material components (hardware) continued to decline (Kauffman and Weill, 1990), resulting in IT permeating every facet of an organization and, concurrently, becoming available for individual use. In the 1990s and beyond, IT further intensified its dominant role by the ever-increasing societal dependence on IT systems that has segmented the labour market into three generic groups: "routine production servers", "in-person servers" and "symbolic analysts" (Reich, 1993). The proliferation of IT has further re-defined traditional routine production work into sequences of repetitive tasks, to the extent that even the supervisors of such tasks are easily replaced. There is, currently, no shortage of such labour and it usually can be found more cheaply in a new market (Reich, 1993). Routine production margins are controlled, profits are usually predictable and workers have a high degree of exposure to global competitive forces.

CONNECTIVITY OR INFORMATION REACH

Whilst, in the past, information components of the value chain have been deeply embedded in the physical value chain, because the information delivered from sender to receiver was carried physically by post, E-mail or orally by the person (face-to-face inter-action or telephone), it reached target audiences only. Information was constrained to follow the linear flow of the physical value chain (Evans and Wurster, 1997). This physical chain of communication media is an invariant property of communication "richness" or "leanness" (Daft and Lengel, 1986). However, with the advancement of IT, there is potential for everyone to be connected electronically, enabling communication rich - information to travel by itself. This, in turn, makes it possible to un-bundle information from its physical carrier (Evans and Wurster, 1997).

Connectivity, or "information reach", is currently limited to the Internet, which connects everyone having access to required technology; extra-nets, which connect organizations to one another and intranets, which connect individuals within organizations (Evans and Wurster, 1997). However, the quality of information or "information richness", defined as 'the ability of information to change understanding within a time interval' (Daft and Lengel, 1986: 554), and characterized by three attributes, is not necessarily compatible with connectivity or "information reach" (Evans and Wurster, 1997):

> The bandwidth, or the amount of information, that can be moved from sender to receiver in a given time (text is narrowband; a multimedia is broadband).
>
> The degree to which information can be customized (TV advertising is less customized than personalized mail, but reaches more people).
>
> The inter-activity (dialogue accommodates exchange between a limited number of people but the monologue can accommodate exchange between one and many).

Although communication media (face-to-face, telephone, E-mail and documents) vary in the capacity to reach and process rich information, there is, currently, no single medium which can achieve both information "richness" and "reach". Some software packages, such as Quicken, Money and proprietary bank software, permit rich exchange but only with the customer's own bank (Evans and Wurster, 1997). Web "browsers" have the potential to reach the entire universe of financial institutions (Evans and Wurster, 1997). However, face-to-face is the richest medium because it provides immediate feed-back so that interpretation can be checked and 'multiple cues, via body language and tone of voice and message content, are expressed in natural language intervals' (Daft and Lengel, 1986: 560).

Information, in many ways, defines pair-wise relations, such as buyer-seller relationships, where, traditionally, much of the trader's margin depended on the asymmetry of information (Evans and Wurster, 1997). For example, in trade, the *caveat emptor* applies and the buyer of goods or services must look out for his/her own interests. Thus, a merchant is permitted to negotiate the best deal he/she can get and need not consider what is in the best interest of the customer. Thus, increasingly, customers value mediums which are both rich and reachable, as he/she will need information that is complete (what was conveyed), truthful (authenticity of conveyed information), clear (what has been conveyed) and contextual (establish context of information origin) (Ngwenyama and Lee, 1997). This validation of information pertaining to the completeness, truthfulness, clarity and contextually, and the sheer breath of choices of medium and databases available to potential customers, will require services of an inter-mediator or a "symbolic analyst" (Reich, 1993) a qualified actor who can access, analyze and synthesize information, can add to the value chain or produce "symbolic goods" (with the focus on intellectual fields) (Bourdieu, 1971; 1979), shape conditions of supply and demand for symbolic goods (the process of competition and monopolization) and mediate the struggle between the established and outsiders.

For example, some organizations have an incentive to create, or simply make available, databases on interest rates, risk ratings and service quality histories. New opportunities will emerge for third parties that neither produce a product nor deliver a primary service inter-mediators (Evans and Wurster, 1997). Navigators or agent brands have been around for long time. For example, restaurant guides influence readers towards a particular establishment. The Platform for Internet Content Selection (PICS) is a programming standard that allows net browsers to interpret third-party rating labels on Web sites. PICS enables users to rate anything and it makes those ratings ubiquitous, serviceable, sortable and costless (Evans and Wurster, 1997). The dramatic proliferation of net-wired matters increases the need for such navigators and other facilitating agents; those that guarantee a product's performance or assumed risk (Evans and Wurster, 1997).

Ethnographic evidence suggests that competition to acquire symbolic goods in the information class generates high admission barriers and effective techniques of exclusion (Douglas and Isherwood, 1980: 180; Industry Commission, 1995). As well, there is the newcomer's perceived need to adopt subversive strategies in order to create a space for themselves and displace the established. This is the very process of de-monopolization and de-hierarchization of previously established and (il)legitimate cultural enclaves which had brought about a phase of cultural de-classification in society and global shifts (DiMaggio, 1987). Cultural shifts need to be comprehended in terms of how they inter-relate to intra-societal, inter-societal and global processes.

CONNECTIVITY AND INTER-ACTIVITY

Notwithstanding that inter-activity is often perceived as a characteristic of dialogue, in reality, it is not limited to un-mediated communication. Rather, inter-activity can be understood as a formal element of both un-mediated and mediated communication. Inter-activity can be conceptualized as a responsiveness in inter-personal and societal communication with a message's thread or chain of inter-related messages (Rogers, 1986; Rafaeli, 1988; Rafaeli and Sudweeks, 1997). Furthermore, the degree to which communication transcends reaction is crucial (Rafaeli, 1988). Thus, one-way communication is not inter-active as there is one source that sets the agenda, receiving no or, in some cases, indirect feedback. Moreover, in two-way and re-active communication, where both sides "send" messages but where there is no *feedback*, there is only potential for inter-activity - two-way communication is present as soon as messages flow bilaterally. Re-active settings require, in addition, that later messages refer to (or cohere with) earlier ones (Rafaeli, 1988:119) before they become inter-active.

At its minimum, effective communication requires one re-active thread, which may reach a fully inter-active level (Rafaeli, 1988). The two-way communication remains re-active unless later messages in any sequence take into account not only the messages that preceded them, but also the manner in which previous messages were re-active (Rafaeli and Sudweeks, 1997). Only then is a fully inter-active level reached, implying that communication roles in inter-active communication are inter-changeable (Rogers, 1995: 314).

Inter-activity is often defined in its wider use to include a variety of meanings (Goertz, 1995; Fredin and David, 1998; McMillan and Downes, 1998) - being "connected" via the "Net" does not necessarily imply inter-activity (Noth, 1996). Electronic media can neither produce nor share meaning in a narrow sense but can only facilitate or impede inter-active communication. The reality is that even episodes of face-to-face communication, regardless of whether they are mediated or not, are seldom fully inter-active, although many aspire towards full inter-activity as it often implies equality of participation (Rafaeli, 1988). Inter-activity, in this narrow sense, describes and prescribes the manner in which conversational inter-action, as an iterative process, leads to jointly-produced meaning (Rafaeli and Sudweeks, 1997). However, it had been argued that different purposes and tasks require different communication settings and different levels of inter-activity (Höflich, 1996).

IT-ENABLED COMMUNICATIONS AND ORGANIZATIONAL CONNECTIVITY

IT connectivity and communication studies are published across many disciplines such as IT; linguistics; psychology; management; business and sociology inducing the rapid proliferation of research. In order to operate effectively in a changing environment, organizations need to process information for the purpose of reducing uncertainty (Galbraith, 1973b) and resolving equivocation (Weick, 1979; Daft and Lengel, 1984; 1986). Organizations need to provide connectivity between organizational actors and their client base. Communication underlies most organizational processes and may, therefore, be considered the essence of organizing as organizational members inter-act internally and externally to co-ordinate activities, disseminate information and make decisions (Galbraith, 1973a; Tushman and Nadler, 1978; Euske and Roberts, 1987; Weick, 1987).

Effective decision-making is dependent upon processing information in an internal and external organizational environment, which continuously changes (Weick, 1987), by permitting horizontal and vertical information flows. Vertical information processing is used to interpret the environment and to reduce uncertainty whilst horizontal information processing serves to co-ordinate internal activities (Daft and Lengel, 1984). In contemporary organizations, IT-mediated communication is seen as a solution for effective horizontal and vertical communication. IT-enabled communication is an a-synchronous, computer-mediated message system that uses computer text processing and communication tools to provide high-speed information exchange (Sproull and Kiesler, 1992). IT-enabled communication media have been defined to include electronic mail; voice mail; computer bulletin boards; computer conferencing; Group-Ware; group-decision support systems, as well as other new forms of structured communication support via computers (Steinfield, 1992: 349).

The distinguishing characteristics of IT-based communication media have been developed around the categories of synchronicity; transmission speed; textual and graphical nature of the medium; its multiplicity of connections; and its storage and manipulation facilities (Garton and Wellman, 1995). Where the medium is more than the carrier of the message, 'the medium itself becomes the message' (Trevino, Daft and Lengel, 1990: 84). That is, effective communication channels need to have the capacity to transmit data and *meaning*. McLuhan (1964) submitted the original proposition in its most extreme form in claiming that "the medium is the message". Later, more moderate versions suggested that the 'medium is also a message' (Garton and Wellman, 1995: 438). Media are also symbols of something and this is defined in the particular context of the organization (Sitkin, Sutcliffe and Barrios-Choplin, 1992).

For example, communication technologies have specific characteristics that condition their impact and use (Culnan and Markus, 1987; Finholt and Sproull, 1990). Electronic mail is a-synchronous, fast, text-based, one-to-one, one-to-many or many-to many. These attributes make new communication activities possible as well as restricting communicative possibilities of conventional channels. As such, electronic mail alters patterns of communication in increasing the vertical and horizontal communication flow through the organization. For example, a-synchronous media, such as electronic mail and voice mail, are able to remove time zones and geographical barriers and to distribute messages to a large number of individuals simultaneously and rapidly. This has been seen as a core advantage of an a-synchronous technology. Simultaneous distribution of information is perceived to enhance an actor's connectivity by more effective co-ordination of project groups, scheduling of meetings and general information exchange. In terms of scope, electronic mail increases the total number of participants in the message system, the number of inter-connections between them and the number of messages sent and received. In increasing the total number of communication participants, IT facilitates the establishment of new contacts within the organization.

At the organizational level, electronic mail is seen as a device for improving effectiveness in expanding the range of information and expertise and facilitating the exchange across the organization and its decision makers (Adams, Todd and Nelson, 1993). Electronic mail is also preferred for communicating negative news in order to avoid open dialogue and conflict resolution (Sproull and Kiesler, 1986).

CONNECTIVITY AND INFORMATION NETWORKS

According to Katz and Kahn (1996), the act of organizing occurs through communication, whereby information is exchanged and meaning fabricated (Orlikowski and Yates, 1994). This view holds that communication is central to the organization process. As such, organizations can be viewed as communication systems in which networks of nodes (individuals, groups, departments) are linked with one another in a variety of ways and linked with elements in their external environments. Weick (1987: 97-98) has argued that inter-personal communication is the 'essence of organization because it creates structures that then affect what else gets said or done and by whom. The structures, in turn, create additional resources for communication, such as hierarchical level, common tasks, exchangeable commodities and negotiable dependencies'.

In reality, all organizations have an information network, although they have been variously named by scholars and practitioners alike such as "communication network" or an "information processing network" (Hubber, 1989). Whatever the label and whatever the mediate used, their transactional content is information. They exist to transfer information from those whose job it is to acquire, store and process information to those who must use the information to make a decision.

The information network can be formal (prescribed) and informal (emergent) information flows in an organization. Information, especially through the network, is an integral part of an organization; it is the essence of any organization affecting structure through the political process. As information flows through the network, it is changed in a number of ways. It is likely to be aggregated. Its meaning may change through interpretation at each node. Information is shaped by particular forms of knowledge when it is created and shaped again by other knowledge when it is received and interpreted. This information does not transfer an objective core of knowledge about the world (the positive interpretation of information) when it is "read" by the recipient. Rather, it enters into a culturally mediated, but under-determined, relationship to the knowledge of the recipient. Organizational members are not homogeneous; different individuals have differing behavioural and personal factors. Interpretation of information is very subjective and dependent not only on task complexity but also on decision-making characteristics. Cognitive style refers to differences that can be perceived in individuals due to differing cognitive structures. Mason and Mitroff (1973) have suggested that each person possesses a particular specific psychological cognitive style or "personality" and that each personality type utilizes information in different ways.

Meaning can never be literally transferred from one person to another all that passes between message sender and message receiver is a pattern of physical stimuli. Computer-mediated communication has the ability to change how information is received and distributed (Kiesler, 1986). This usually results in a fundamental change in the information that is made available to organizational members and the source of that information. Nodes on the information network can be by-passed, whilst having access to an information source may reduce the negative consequences of varying interpretations.

ELECTRONIC GROUPS, NETWORKED AND VIRTUAL ORGANIZATIONAL DESIGNS

In contrast to conventional groups, electronic groups are supported by IT-enabled communication media such as electronic mail and Group-Ware systems (Lotus Notes; Microsoft Exchange). The Group-Ware technology allows individuals to form groups for emerging purposes that cut across geographic and departmental boundaries. Group-Ware substantially facilitates information exchange and decision-making in groups independent of physical location. Whilst Group-Ware technologies might produce efficiency gains, they may, alternatively, create new or different forms of groups and, as such, induce un-desirable organizational consequences, as management policies strongly influence the nature of electronic groups (Finholt and Sproull, 1990). Thus, the activities and the ratio of positive and negative consequences for the organization through

> attributes of group behaviour (a physical setting, member characteristics, membership criteria, task type);

processes of group behaviour (inter-action, influence attempts, identity maintenance); and

organizational consequences of group behaviour (participation, performance, learning)

are all modified by organizational polices and organizational actors. Media usage left to discretion and self-policing may account for negative effects such as information over-load or abuse (Finholt and Sproull, 1990). Furthermore, technical policies may include the installation of filters and group directories. At the social level, norms and codes for use should be endorsed to encourage responsible and effective technology use.

New designs and structures which have been depicted as the breakdown of hierarchy are enabled through the emergence of IT-mediated communication (Marlow and Wilson, 1997). The inter-active, multi-level capabilities of communication technologies compel change in conventional organizational activities and designs and, as such, drive the emergence of new organizational forms, exemplified by the network or the virtual organization. Their value has been specifically identified in relation to the organization's inter-actions with external constituencies. The new organizations capture value in shifting from the traditional "make and sell" to the new IT-enabled paradigm of "sense and respond" (Bradley and Nolan, 1998). New, inter-active communication networks enable organizations to sense, in real time, customer's needs and to respond swiftly and effectively. The speed with which advances are currently being made in the business applications of information and communication technologies triggers an unprecedented change in organizations, industries, business and society such that those who study these changes are only beginning to understand (Bradley and Nolan, 1998).

Propelled by advances in information technologies and socio-economic changes, many organizations have adopted, or are beginning to experiment with, "virtual" ways of working. Included in these ways of working are modes such as tele-commuting, working from satellite centres, mobile work and the like. In some organizations, it is no longer important when or where employees work, as long as the work is performed on time and efficiently. The emerging organizational forms represent a shift in the organization of work done by large corporations that have created mass-production systems, which, in turn, have required the congregation of organizational employees at central places of work (Garud and Rappa, 1994). The advent of information technologies has enabled a de-centralization of work by facilitating organization members to work together while being spatially and temporarily de-coupled from one another.

Although IT facilitates critical organizational functions, it also poses a particular challenge in virtual contexts (Korac-Kakabadse, Korac-Kakabadse and Kouzmin, 1999). These are co-ordination and control of dispersed organizational actors; work group functioning; encouragement of extra-role citizenship behaviours; and retention of valuable employees. Achieving co-ordination and control in virtual organizations is increasingly difficult as more organization members are expected to perform functions that are not fully predictable, not easily measurable and require high levels of inter-action with others; factors which may complicate a worker's ability to perform virtually (DeSanctis, 1984). Co-ordination and control, which are essential ingredients to organizational efficiency and effectiveness, become increasingly difficult in virtual environments as organization member's productivity depends upon the ability to formulate reliable expectations about other's behaviour and to rely on others to perform the functions that they are assigned in a consistent and timely manner (DeSanctis, 1984).

SYMBOLIC ANALYSTS OR "TECHNICIZATION" OF WORK

Although IT is held as a liberator of knowledge, separated from the certainty of history, technology seems to re-inforce a "crisis of knowledge", in turn, often producing a dis-connectedness from rationality (Connell, 1997). In this shifting territory of fading knowledge, the sensation that there is causation seems strangely vacuous. Information, in its current usage, is utilitarianism *in extremis*, circumventing modernist proposals about where things come from (Breen, 1997). This fading of knowledge is aligned with the absence of a structured critique, producing deep confusion in surface discourses about information (Roszak, 1994). As information moves rapidly across the surface of everyday lives, its dis-articulation from knowledge may produce a knowledge crisis. Whilst, at present, it is difficult to ascertain the size of the symbolic analyst occupation as a category, because it is often associated with technicians, ones who inter-act with IT or administrative support groups, it can be inferred that numbers are growing. Since mid-century, the percentage of Americans employed in "service" and professional occupations ranked second (89 per cent) and third (82 per cent) for growth, whilst growth of the technician's category has grown by 240 per cent (Barley, 1996). Computer technicians and automobile technicians are grouped beneath the 'precision production, craft and repair occupation' whilst computer operators are counted with 'administrative support occupations' (Barley, 1996: 410).

One of the biggest impediments to E-business is the fact that computers and Webs are not very effective in recognizing context; thus, many Web searches result in unwanted information. The reason is that the Web's main language, HTML (hypertext markup language), is essentially superficial. It tells a Web browser how to lay out the contents of a Web page, but it remains ignorant of the content. The World Wide Web Consortium (W3C) developed an extension to HTML, called XML (eXtensible Makeup Language), which, in addition to describing content, also provides a way of indexing data (*The Economist*, 1999a). It is a system of tagging data with relevant information, allowing applications running on the computers to respond in an appropriate way. For example, XML makes it clear that "The Times" is a newspaper and in a particular time zone. By using meta-tagging data that describes data, XML can also speed searches in the way a librarian's card index can. However, in order for XML to work effectively, there is also a need for some agreement on definitions. This can be achieved within particular professions, such as medicine, although there is a need for a shared language of business, on the Internet, across industry. Microsoft is using its market clout to enforce global standards via its product, "BizTalk", which will be incorporated into Office, BackOffice and Windows (*The Economist*, 1999a).

THE RISE OF THE INFO-MEDIARY

IT has had significant effects on organizations. Organizations are changing the way they operate due to significant reductions in the cost of obtaining, processing and transmitting information (Porter and Millar, 1985; Malone, Yates and Benjamin, 1987; Rockart and Scott Morton, 1993). Information accessibility makes radical changes possible in management praxis which, in turn, affects organizational and market structures. Although electronic data processing and telecommunications infrastructures have supported the development of extended global enterprises (Harasim, 1993; Konsynski and Karimi, 1993), they have, at the same time, induced de-integration of industrial structures, thus, resulting in "virtual corporations" or "networked organizations" (Rheingold, 1993; Rockart & Scott Morton, 1993). This, in turn, facilitates continuous evolution of a firm's value chain of production of a good or service and distribution (Porter, 1985). The potential of IT to transform value systems of many organizations is, thus, far greater now than it has been in the past, as technology enables producers of goods and services to directly inter-act with consumers. Some producers are taking advantage of direct electronic links with consumers. However, short E-commerce history shows that this direct link is increasingly mediated by a new breed of inter-mediaries the electronic market *has not* eliminated intermediaries from the value system.

TABLE 1
REDUCING COST THROUGH INFORMATION EXCHANGE

Activity	Potential Impact of Web-Based Technology
Administration	Electronic transmission of orders and invoices directly between customer and suppliers B2B E-commerce.
Inventory	Sharing information on stock and demand to avoid an enterprise carrying unnecessary stock Just-in-Time stock supply.
Transport/Storage	Optimizing delivery to nearest transport or storage space is utilized effectively to meet agreed service levels.
Design	Sharing product design data inter-actively to enable faster development of better products and less "re-work."
Financing	Electronic payment to improve cash flow, reduce the need for working capital and reduce costs.
Capacity	Matching the use of resources across firms to avoid idle resources in one part of the supply chain and/or overload in another.
Services	Linking third-party service suppliers to search requests to reduce delays in delivery and cost of administration.

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Although IT allows producers to internalize activities that have been traditionally performed by inter-mediaries and, at the same time, "capture value" and re-distribute profits along the value system, inter-mediaries have not disappeared they have been *transformed*. The network's ability to support direct exchanges efficiently will increase both producer and consumer welfare (Benjamin and Wigand, 1995). Notwithstanding that it has been shown that inter-mediaries add significant costs to the value chain, reflected in higher final prices of products or services, whenever a transaction takes place directly between producer and consumers or through third-party market facilitators, both producers and consumers benefit. The producer gets to retain a higher portion of surplus value generated along the value system, while the consumer benefits from both a larger choice and lower prices for services (Benjamin and Wigand, 1995).

According to Transaction Cost Theory (Coase, 1937; Williamson, 1975), a producer of goods and services has two options for organizing economic activities; an internal hierarchical structure which integrates the activity into its management structure or a market-like relationship with external firms (Williamson, 1975). When the market mechanism is at work, the flow of materials and services takes the form of external transactions and is co-ordinated by market forces. In the context of E-distribution channels, organizations can decide whether to "make or buy" (Rangan, Menezes and Maier, 1992) an inter-mediary function; that is, whether to internalize the channel activity or sub-activities within its organizational boundaries or choose to rely on the market.

Malone et al. (1987) were among the first to link the Transaction Cost Theory to electronic communication, illustrating how electronic networks can lower the costs of transactions and influence the formation of both electronic markets and electronic hierarchies. More efficient transactions help organizations reduce the costs of co-ordination, defined as the transaction costs of all the information processing necessary to co-ordinate the work of people and machines that perform the primary processes [and] take into account the costs of gathering information, negotiating contracts and protecting against the risks of "opportunistic bargaining" (Malone et al., 1987: 485). Following this line of thought, it is held that networks encourage vertical de-integration of firms by lowering the cost of "buying" compared to "making" in-house (Malone et al., 1987; Malone, Yates and Benjamin, 1989). For this very reason, producers outsource inter-mediary functions, resulting in a greater reliance on inter-mediaries, as the reduced co-ordination costs imply an "un-bundling" of functions, making it easier and more efficient to buy value-chain functions rather than to make them in-house.

Thus, Internet, Web and related E-business technologies were expected to eliminate, or at least marginalize, dealers, distributors and other commercial go-between middle-men, by putting buyers and sellers of goods and services in direct contact, by-passing inter-mediaries and creating "dis-inter-mediation" of the market (Preston, 1999). The reality is that these technologies have attracted hundreds of new companies whose main purpose is to hook up sellers and buyers, thus, a new kind of middle-man creating the "re-inter-mediation" of market by a new breed of middle-man the infomediaries (Hagel and Raypoert, 1997; *The Economist*, 1999a; 1999b). "Info-Mediaries", together with "aggregators", "hubs", "auction sites", "portals" and "exchanges", are labels used for the E-based companies which aim to improve market-clearing dynamics by leveraging the accessibility, efficiency and information-richness of the Web, each having a specific focus.

For example, aggregators, exemplified by Chemdex, help buyers in fragmented markets select products by providing up-to-the-minute price and product information and a single contact point for service (providing a one-stop-shop for academic research and a service for companies in the pharmaceutical and bio-technology business to purchase all their supplies). On-line auctioneers, exemplified by Adaction.com, offers a reliable channel for sellers to dispose of perishable or surplus goods or services at the best possible prices and for buyers to get bargain prices without taking a leap into the unknown. It offers media buyers the ability to bid for specific product category via a tune-in, first-come, first-serve basis through "Opportunity Exchange" and by automating bidding through an agent called "ProxyMan". Exchanges, exemplified by NTE, create liquidity in otherwise fragmented markets, lower average stock levels by matching bid/ask offers and act as neutral third parties enforcing market rules and settlement terms (*The Economist*, 1999a; 1999b).

The appeal of the modern-day middle-man, info-mediaries, are based on their unique ability to exploit the Internet's three most salient characteristics. First, it shifts power from sellers to buyers by reducing the cost of switch suppliers and freely distributing a larger amount of price and product information *(The*

Economist, 1999a; 1999b). As a result, many buyers feel liberated and free to make choices; others feel overwhelmed by the amount of available information and choices. These buyers prefer one-stop-shops and are prepared to pay for information they know is accurate and trustworthy and which provides opportunities for third-party sellers (*The Economist*, 1999a; 1999b). Information is particularly powerful as it applies to business-to-business sales, mainly because business buys more on-line than the consumer. In the US alone, business-to-business E-commerce is expected to be US$1.3 trillion by 2003, compared with US$108 billion with consumers (Forester Research, 1999). These info-mediaries create liquidity by making real-time information available and the price easily accessible. In the process, they adjust prices more closely to demand and they often handle settlements (Preston, 1999). For example, Instill Market Intelligence, which offers subscriptions to the purchase data generated from the transaction-level purchase data gathered from the operator, invoices on its purchase procurement service an E-marketplace for the food service industry. Access to data lets manufactures effectively manage production, plan new products and markets and sell existing products to the best-suited buyers prepared to pay US$100,000 per year, per product category (Hagel and Raypoert, 1997).

Secondly, the Internet reduces transaction costs and, thus, creates economic activity. A bank transaction via the Internet costs one cent, compared with 27 cents at an ATM or 52 cents over the telephone. Processing an airline ticket on the Internet costs US$1, whilst, through a travel agent, it incurs US$8 in charges. However, these savings are available to large businesses, such as financial institutions, creating opportunities for info-mediaries by linking buyers and sellers via the Internet and achieving savings for both in markets where they might otherwise miss out (*The Economist*, 1999a; 1999b).

The third fact is that the speed, range and accessibility of information from the Internet, and the low cost of distribution and capturing it, create new commercial possibilities. Info-Mediaries, sitting in the middle between buyers and sellers, are uniquely placed to collect information, add value to it and distribute it to those who will find it more useful *(The Economist*, 1999a; 1999b). These info-mediaries can create a monopoly as they use information to attract more buyers and sellers and, simultaneously, *learn* more in the course of their business transactions. However, info-mediaries can also use information to solve particular problems for a particular vertical market. By defining distinct focus, info-mediaries can provide a depth of information and drive transactions by generating customer loyalty and participation. Increased customer participation, on the other hand, increases the depth of the info-mediary's knowledge base which, in turn, attracts more transactions. The key to modern-day middle-men is to add value (Preston, 1999). Web-based inter-mediation has a strong client base in utility services such as electricity, natural gas and international telecom, whilst it is increasingly gaining market share in the metal, timber, steel, transport, plastic, food service and computing industries (Preston, 1999).

However, info-mediaries have access to the consumer's credit status as they match the individual up with the right service providers (Hill, 1998). The down-side is that info-mediaries sell consumer information to third parties, impinging on consumer privacy. Although there are honest on-line brokers who behave with integrity, and consumers do trust them with their personal profiles, the majority of info-mediaries sell consumer's data to others. Some have suggested that info-mediaries can perform a dual role of broker and gate-keeper, where the consumer will be in charge of a brand called "me" and would charge the info-mediary for selling this data. Although some consumers would welcome such a move, research data suggest that 84 per cent of 10,000 Web users are content for providers of services and/or info-mediaries to sell information to other companies (Lach, 1999). Some are developing software tools that will capture and negotiate a consumer's commercial identity so that the balance of power in the sale chain can be re-ordered (Gerland, 1997). When a company desires to know a consumer's tastes or to examine past transaction histories, the software info-mediary will determine the validity of the request and will then determine some kind of payment for the use of the data. In the end, electronic marketplaces will determine the pricing of such data. However, the decision as to who will accurately build and maintain such software agents is still debatable (Gerland, 1997).

THE IMPACT OF WEB-BASED TECHNOLOGY ON INTER-MEDIARIES

Web-based technology presents enterprises with choices as to how to position themselves in the anticipated future market. Although there are many options, they can be clustered into five categories, depending on the function web technology is employed to perform; namely, substituted/re-configured, dis-inter-mediation, re-inter-mediation, partial inter-mediation and complimentary inter-mediation.

Substituted/Re-Configured Inter-Mediaries Web-based technologies can offer substituted and re-configured products and, thus, change or re-configure traditional inter-mediates. For example, an electronic channel may enable the underlying customer need to be satisfied in a different way or by "substitute products", exemplified by E-mail and physical post. This substitute provides a threat to traditional inter-mediaries, such as paper manufactures, stationers and post offices. In addition, customer needs may be bundled into different product configurations or "re-configured products", such as newspapers, which provide news, job vacancies and advertisements that is, provide the bonded value of newspaper services with other types of value. However, some portals, such as Yahoo, meet some of those needs and poses a threat to the traditional news inter-mediaries the newspapers.

Dis-Inter-Mediation With other IT-enabled channels, such as call centres, Web-based technology can enable a link to be removed from the market by removing inter-mediaries whose primary function of information transfer can be more effectively performed using the Internet. Examples are telephone and Internet banking, direct purchasing, such as offered by Amazon.com, by-passing sale agents and distributors used by consumer goods manufactures selling direct to retailers.

Re-Inter-Mediation Increasingly, instead of by-passing traditional inter-mediaries, they are replaced by new on-line info-mediaries. For example, on-line sites which automatically search for the cheapest car insurance are competing with telephone-based brokers, causing the demise of the Automobile Association's (AA's) high-street shops in the UK. Similarly, General Electric's TPN Register provides an on-line marketplace between suppliers, on the one hand, and GE and its partners on the other. There are new integrating info-mediators that provide integrated services, whilst others, exemplified by Japan Airlines, puts out open invitations for tender to suppliers on their web site. There are also market makers, such as action sites which are tied neither to the buyer nor the seller. Some inter-mediaries are closer to vendors, such as Auto-by-Tel, which passes on leads to local dealers. A more buyer-oriented inter-mediary, such as the TPN Register, sets up a consortium of buyers in order to ensure that they gain low prices through economy of scale. There are a variety of inter-mediaries and, according to their orientations, may be classified as vendor-oriented or buyer-oriented, with market makers being in neutral positions. Web technology-based info-mediators are summarized below:

TABLE 2
TYPES OF INFO-MEDIATORS

Inter-Mediary Type	**Inter-Mediary Form**
Vendor-controlled	Vendor Web site (Coachyou, E-Strategy Consulting Practice)
Vendor-oriented	Vendor run community *(Yahoo!, Cambridge Information Net, AOL)* • Consortium distribution *(Theatreline, Euro-tec)* • Vendor's agent *(Chemdex)* • Lead generator *(Auto-By-Tel)* • Audience broker *(Double-Click, E*Trade)*
Un-biased	User-created autonomous multi-agent *(Kasbah)* • Market maker *(eBay, Priceline, Petrocoms)* • Shop *(ShopSmart.com)* • *Mall (msn.com, bcity.com)*
Buyer-oriented	Purchaser's agent *(Comparene, Autoland)* • Purchasing aggregator *(TPN Register, InsWeb, Lending Tree)*
Buyer-controlled	Buyer Web Site *(Japan Airlines, Finder)*

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Partial Inter-Mediation Partial inter-mediation is a halfway house. In some cases, an inter-mediary's role may be reduced, but not eliminated, through some value being provided remotely by the supplier to the intermediary's customer. Web sites, exemplified by those of car manufacturers, may build a brand and provide customer information while pointing customers to traditional outlets for actual purchases.

Complimentary Informediation Although, at times, the links in the value chain may remain the same, communication between them may be partially or fully switched to Web-based communication from the previous media or mechanism (that is, media switching or addition to existing communication). For example, Dell's addition of the Internet to its other means of communication with customers and RS Components, who have, similarly, added a Web channel to its dominant telephone sales model whilst selling to the same customer base.

TOWARD "SEAMLESS" ELECTRONIC MARKETPLACES

At the beginning of the last century, crude oil was nicknamed "black gold" for its capacity to forge new wealth. At the beginning of the 21st century, the new gold is consumer information the data stream, data capture and data mining that, with the proliferation of the Internet, adds to a new currency of "infonomics". Customer information and a variety of data analysis techniques save marketing overheads by eliminating inappropriate customers and increase "cross sell" and "up-sell" to customers who are ready to experience new services or products (*The Economist,* 1999a). The marketing mantra of the last decade of the 20th century was "segmentation", which turned into the elusive idea of "one-to-one marketing", only to become a reality with the proliferation of Internet and Web-based technologies creating "mass personalization" of products and services. Whether on-line or off-line, enterprises pursue Pareto's Law, whereby they can make 80 per cent of their revenues from 20 per cent of their existent customer base hence, the reason why airlines, banks and stockbrokers service the top one per cent of their clients with "deluxe" attention while the "proles" line up in queues (*The Economist,* 2000). However Pareto's Law assumes that the enterprise already has customer information. Marketing departments are increasingly under pressure to increase their enterprise's profitability by 80 per cent by improving their customer relationship by 5 per cent which, in some cases, could mean a difference of £1billion (*The Economist,* 2000). Capturing customers' information allows personalized marketing to become more important on the value chain.

In addition to purchasing customers information from third parties, Internet-based enterprises are able to practice explicit and implicit data collection and marketing. In explicit data collection, customers are asked questions during the initial registration process which they voluntarily answer (American Express, Fly Buys). Implicit data collection is more subtle and, perhaps, less ethical. The Internet site tracks what an individual customer or visitor is doing on that site; they follow individuals and make assumptions about what the individual desires (Wellman and Wurman, 1998). These sites leave an identifier, a "cookie", in a visitor's computer, so whenever an individual returns to the site, the "cookie" triggers a recognition that pulls and builds an individual's history. Rule-based expert system engines, or personalization engines, then decide how the site should respond to an individual's browsing session (*The Economist,* 1999a). A book retailer, such as Amazon.com, has personalization engines that decide what books one may be interested in, based on previous titles one has bought. MyYahoo! for example, uses the dynamic personalization engine that resides in the centre of the Internet's most-used directory. The information that MyYahoo! gathers, non-stop, as soon as a visitor enters one of its sites is used to bring the user further and further into a community. All the features of Yahoo! are personalized, from clubs and football tipping, chats and auctions, to the mail and message services. All features contain customized elements that consumers control (Wellman and Wurman, 1998). Hence, Yahoo is less likely to serve banner ads or promotions that are unwanted. The power of using customer information in the manner that is appealing to each individual is the difference between "spam" and the "helpful offer" or good customer relationships (*The Economist,* 2000).

In addition to Internet-based data collection, many enterprises collect customer information via "call centres" as well. Calling Line Identifier (CLI) software sends a caller's number to a customer database and looks for a match with its records. The search is automatically narrowed down to segments as the Web site shows different call numbers depending on who browses the site.

The power of personalization and the ability of the Internet have opened many possibilities for marketing. Increasingly, "old" Web developers are becoming business integrators who build complex, data-based E-commerce sites founded on an information architecture that utilizes the Internet from the perspective of the type of information the enterprise wants and the type of presentation likely to elicit it from customers. Increasingly, many portals are being replaced by info-mediary sites. Portals are generally understood to mean a starting point through which one enters the Web but, in the business-to-business (B2B) arena, it usually means entrance to a Net marketplace where users are provided with news and value-added services related to the business or industry the marketplace serves. Electronic marketplaces are Web sites where users go to buy and sell. Marketplaces are formed by collections of software agents which inter-act with one another in order to automatically negotiate and form partnerships or trade products and services through the Internet (Nomura International Plc, 2000). Whilst the marketplace's main role is to facilitate inter-action between agents, it may play other roles depending on the type of market. For example, a marketplace serving a particular industry might display commodity prices and may contain discussion groups or bulletin boards related to the interests of purchasers that it would like to attract. It also offers a searchable database of the products available from the suppliers participating in the marketplace (Wellman and Wurman,1998). It also determines the terminology spoken; that is, how goods and services are described. As original portals were not designed to collect customer information they are now being upgraded or replaced by info-mediary engines.

Hence, the "owners" of E-space in the next few years will be huge database enterprises or electronic info-mediaries that act on behalf of customers to source the most effective goods or services. Through the spending power they represent, these sites will be able to gain discounts and special offers for users. For example, InsWeb insurance polices and LendingTree for home loans, will find the best deal available on the Internet.

CONCLUSION

The idea behind the electronic marketplace is that the product content and the necessary infrastructure are provided by someone else and not by the market site. Venture capitalist, software providers and, most significantly, purchasing organizations themselves, usually in industry-wide collaborations that include players from every phase of the supply chains, are embracing net-marketplaces (Jennings, Sycura and Wooldridge, 1998). There are currently more than 600 Net marketplaces in existence and it is expected that by 2003 there will be as many as 10,000.

TABLE 3
ELECTRONIC MARKET-PLACE DESIGN CHALLENGES

Challenge Type	Exception Class
Unreliable infrastructures	Infrastructure failure (slow host, agent death, lost/garbled messages).
Limited trust	Protocol violations (fraudulent bids, agent skills change, contractor refuses payment).
Systemic failure	Systemic expressions (no capable agents, biased bid selections, no available agent due to resource poaching by lower priority tasks).

Source: Chia, Neiman and Lesser (1998)

Whilst Internet, Web and related E-business technologies where expected to eliminate, or at least marginalize, dealers, distributors and other commercial go-between middle-men, by putting buyers and sellers of goods and services in direct contact, by-passing intermediaries and creating "dis-inter-mediation" of the market, the current reality is that these technologies have attracted hundreds of new companies whose main purpose is to link sellers and buyers, creating new kinds of middle-men and creating "re-inter-mediation" of markets by a new breed of middle-men the info-mediaries (Wellman and Wurman, 1998). The appeal of modern-day middle-man info-mediaries is based on their unique ability to exploit the Internet's three most salient characteristics; namely, the potential to shift power from sellers to buyers, potential reduction of transaction costs and speed of transactions. An example is the banking sector where distribution of banking products is being dis-inter-mediated with the support of technology starting with automated teller machines (ATMs), telephone banking, PC-based proprietary systems and the Internet, only to be replaced by info-mediatory and personalized services. Further info-mediation will be experienced in the banking sector when Internet and related technologies by-pass banks in payments, clearing and settlement (Preston,1999).

However, the design of efficient and robust electronic marketplaces, whose participants are independently developed software agents, is a challenging task the main challenges being unreliable infrastructure, limited trust and systemic failures (Chia, Neiman and Lesser, 1998). The organizational design implications of these vulnerabilities leave a great deal of uncertainty for inter-organizational(Net) transactions, as they do for software development seeking to further re-engineer transactional dependancies.

REFERENCES

Adams, D. A., Todd, P. A., & Nelson, R. R. (1993). "A Comparative Evaluation of the Impact of Electronic and Voice Mail on Organizational Communication. *Information and Management, 24, 1*, 9-21.

[Australia] Industry Commission (1995). *Computer Hardware, Software and Related Service Industries* (Draft Report), Industry Commission, Canberra, April.

Barley, S. R. (1996). "Technicians in the Workplace: Ethnographic Evidence for Bringing Work Into Organization Studies. *Administrative Science Quarterly, 41, 3*, September, 404-441.

Benjamin, R., & Wigand, R. (1995). "Electronic Markets and Virtual Value Chains on the Information Highway. *Sloan Management Review, 36, 2*, Winter, 62-72.

Bourdieu, P. (1971). "Intellectual Field and Creative Project. In Young, M. (Ed.). *Knowledge and Control*, London: Collier-Macmillan, 64-83.

Bourdieu, P. (1979). "The Production of Belief: Contribution to An Economy of Symbolic Goods. *Media, Culture and Society, 2, 1*, 48-53.

Bradley, S. B., & Nolan, R. L. (1998). "Capturing Value in the Network Era. In Bradley, S. B. and Nolan, R. L. (Eds.). *Sense and Respond*, Boston: Harvard Business School Press, 3-29.

Breen, M. (1997). "Information Does Not Equal Knowledge: Theorizing the Political Economy of Virtuality. *Journal of Computer-Mediated Communication, 3, 3*, pp 17-28.

Chia, M. H., Neiman, D. E., & Lesser, V. R. (1998). "Poaching and Distraction in A-synchronous Agent Activity. In *Proceedings of the Third International Conference on Milti-Agent Systems*, Paris, July, 88-95.

Child, J. (1987). "Information Technology, Organization and the Response to Strategic Challenges. *California Management Review, 30, 1*, 33-50.

Coase, R. (1937). "The Nature of the Firm. *Economica, 4*, November, 386-405.

Connell, R. (1997). "Notes on the World Intelligentsia. *The UTS Review, 3, 1*, 74-86.

Culnan, M., & Markus, L. (1987). "Information Technologies. In Jablin, F. M., Putnam, L. L., Roberts, K. H., & Porter, L. W. (Eds.). *Handbook of Organizational Communication*, Newbury Park: Sage Publications, 420-443.

Daft, R. L., & Lengel, R. H. (1984). "Information Richness: A New Approach to Managerial Behaviour and Organizational Design. *Research in Organizational Behavior, 6, 2*, 191-233.

Daft, R. L and Lengel, R. H (1986). "Organizational Information Requirements, Media Richness and Structural Design. *Management Science, 32, 5*, 554-571.

DeSanctis, G. (1984). "Attitudes Toward Telecommuting: Implications for Work-at-home Programs. *Information and Management, 7, 1*, 133-139.

DiMaggio, P. (1987). "Classification of Art. *American Sociological Review, 52, 4*, 147-169.

Douglas, M., & Isherwood, B. (1980). *The World of Goods*, Hammondsworth: Penguin.

The Economist (1999a). "The Net Imperative: Business and the Internet. *351, 8125*, 5-44.

The Economist (1999b). "Survey: Business and the Internet the Rise of the Infomediary. *351*, 8125, B21-B24.

The Economist (2000). "A Survey of Online Finance: The Virtual Threat. *355, 8171*, pp 1-43.

Euske, N. A and Roberts, K. H (1987). "Evolving Perspectives in Organization Theory: Communication Implications. In Jablin, F.M., Putnam, L.L., Roberts, K.H. and Porter, L.W. (Eds.). *Handbook of Organizational Communication*, Newbury Park: Sage Publications, 41-69.

Evans, P. B., & Wurster, T. S. (1997). "Strategy and the New Economics of Information. *Harvard Business Review, 75, 5*, September-October, 71-82.

Finholt, T., & Sproull, L. S (1990). "Electronic Groups at Work. *Organization Science, 1, 1*, 41-64.

Forester Research Inc. (1999). *Outsourcing's Future: Report*, Cambridge: Forester Research Inc., April.

Forester, T. (Ed.) (1985). *The Information Technology Revolution*, Oxford: Blackwell.

Forester, T. (Ed.) (1989). *Computers in the Human Context: Information Technology, Productivity and People*, Oxford: Blackwell.

Fredin, E. S., and David, P. (1998). "Browsing and the Hypermedia Interaction Cycle: A Model of Self-efficacy and Goal Dynamics. *Journalism and Mass Communication Quarterly, 75, 1*, 35-55.

Galbraith, J R (1973a). *Strategies of Organization Design*, Reading: Addison-Wesley.

Galbraith, J R (1973b). *Designing Complex Organizations*, Reading: Addison-Wesley.

Garton, L., & Wellman, B. (1995). "Social Impacts of Electronic Mail in Organizations: A Review of the Research Literature. *Communication Yearbook, 18*, 434-453.

Garud, R., & Rappa, M. (1994). "A Socio-cognitive Model of Technology Evolution. *Organization Science, 5, 3*, 344-362.

Gerland, E. (1997). "Know Your E-rights. *Brandweek, 38*, 21, IQ30-IQ32.

Goertz, L. (1995). "Wie Interaktiv Sind Medien? Auf Dem Weg Zu Einer Definition Von Interaktivität. *Rundfunk und Fernsehen, 43, 4*, 477-493.

Hagel, J., III., & Raypoert, S. (1997). "The Infomediaries. *Mckinsey Quarterly, 2*, 54-70.

Hammer, M., & Champy, J. (1993). *Re-engineering the Corporation: A Manifesto for Business Revolution*, New York: Harper Business.

Harasim, L. M. (Ed.) (1993). *Global Networks: Computers and International Communication*, Cambridge: Mit Press.

Hill, B. (1998). "Turning the Table on Tradition. *Credit Control, 19, 10*, 22-25.

Hill, S. (1988). *Competition and Control At Work: the New Industrial Sociology*, London: Gower.

Höflich, J. R. (1996). *Technisch Vermittelte Interpersonale Kommunikation*, Opladen: Westdeutscher Verlag.

Hubber, S. (1989). *The Impact of Stereotypes on Personal Judgement*, New York: Lang.

Jennings, N. R., Sycura, K., & Wooldridge, M. (1998). "A Roadmap of Agent Research Development. *Autonomous Agents and Multi-Agents Systems, 1, 1*, 7-38.

Katz, D., & Khan, R. L. (1996). *The Social Psychology of Organizations*, New York: John Wiley.

Kauffman, R. J., & Weill, P. (1990). "An Evaluative Framework for Research on the Performance Effects on Information Technology Investment. *Information System Research, 1, 4*, 377-388.

Kiesler, S., (1986). "The Hidden Messages in Computer Networks. *Harvard Business Review, 64, 1*, January-February, 46-60.

Konsynski, B., & Karimi, J. (1993). "On the Design of Global Information Systems. In Bradley, S., Hausman, J. and Nolan, R. (Eds.). *Globalization, Technology and Competition: The Fusion of Computers and Telecommunications in the 1990s*, Boston: Harvard Business School Press, 81-108.

Korac-Boisvert, N. (1992). "Developing Economies and Information Technology: A Meta-policy Review. Paper Presented at the *Australian and New Zealand Academy of Management's (Anzam) Annual Conference on Re-discovering Australasian Management Competence in a Global Context*, December, Sydney, 1-34.

Korac-Kakabadse, N., Korac-Kakabadse, A., & Kouzmin, A. (1999). "Dys-functionality in 'Citizenship' Behaviour in Decentralized Organizations: A Research Note. *Journal of Managerial Psychology, 14, 7/8*, 526-544.

Lach, J. (1999). "The New Gatekeepers. *American Demographics, 21, 6*, 41-47.

Malone, T., Yates, J., & Benjamin, R. (1987). "Electronic Markets and Electronic Hierarchies: Effects of Information Technology on Market Structure and Corporate Strategies. *Communications of the ACM, 30, 6*, 484-497.

Malone, T., Yates, J., & Benjamin, R. (1989). "The Logic of Electronic Markets. *Harvard Business Review, 65, 3*, May-june, 166-171.

Marlow, E., & Wilson P. O. (1997). *The Breakdown of Hierarchy: Communicating in the Evolving Workplace*, Boston: Butterworth-heinemann.

Mason, R. O., & Mitroff, I. (1973). *Challenging Strategic Planning Assumptions*, New York: John Wiley.

Mcateer, P. F. (1994). "Harnessing the Power of Technology. *Training and Development, 48, 8*, 64-68.

Mcluhan, M. (1964). *Understanding Media: The Extension of Man*, Cambridge: Mit Press.

Mcmillan, S. J., & Downes, E. J. (1998). "Interactivity: A Qualitative Exploration of Definitions and Models. Paper Presented at the *18th Annual Meeting of the Association for Education in Journalism and Mass Communication*, Baltimore, August.

Muetzelfeldt, M. (1988). "The Ideology of Consumption Within the Mode of Production. Paper Presented to the *Sociological Association of Australia and New Zealand Annual Conference*, Canberra, May.

Ngwenyama, O. K., & Lee, A. S. (1997). "Communication Richness in Electronic Mail: Critical Social Theory and the Contextuality of Meaning. *MIS Quarterly, 21, 2*, 145-167.

Nomura International PLC (2000). *E-commerce: Volume I—focus on Infomediaries*, London: Nomura Equity Research Internet Group.

Noth, D. P. (1996). "Interactive Or Hyperactive? Newspapers and Other Sites Abuse the Term. *Dom's Domain* [Online], Available: Http://206.216.217.100:80/dom/colinter.html [1999, 20 July]

Orlikowski, W. J., & Yates, J. (1994). "Genre Repertoire: The Structuring of Communicative Practices in Organizations. *Administrative Science Quarterly, 39, 4*, December, 541-574.

Porter, M. (1985). *Competitive Advantage*, New York: Free Press.

Porter, M. E., & Millar, V. (1985). "How Information Gives You Competitive Advantage. *Harvard Business Review, 63, 4*, July-August, 149-160.

Preston, R. (1999). "Web Emerges as Ultimate Intermediary in Commerce. *Internetweek*, Issue 775, 2 August, 7-12.

Rafaeli, S. (1988). "Interactivity: From New Media to Communication. In Hawkins, R. P., Wiemann, J. M., and Pingree, S. (Eds.), *Advancing Communication Science: Merging Mass and Interpersonal Processes*, Newbury Park: Sage, 110-134.

Rafaeli, S., & Sudweeks, F. (1997). "Networked Interactivity. *Journal of Computer Mediated Communication, 2, 4* [Online].

Rangan, K. V., Menezes, M. A. J., & Maier, E. P. (1992). "Channel Selection for New Industrial Products: A Framework, Method and Application. *Journal of Marketing, 56*, 69-82.

Reich, R. B. (1993). *The Work of Nations: Preparing Ourselves for 21st Century Capitalism*, London: Simon and Schuster.

Rheingold, H. (1993). *The Virtual Community*, Reading: Addison-wesley.

Rockart, J., & Scott Morton, P.' (1993). :Networked Forms of Organization. In Scott Morton, P. (Ed.), *the Corporation of the 1990s*, New York: Oxford University Press, 182-201.

Rogers, E. M. (1986). *Communication Technology: the New Media in Society*, New York: Free Press.

Rogers, E. M. (1995). *Diffusion of Innovations* (Fourth Edition), New York: Free Press.

Roszak, T. (1986). *The Cult of Information*, Cambridge: Butterworth.

Roszak, T. (1994). *The Cult of Information: A Neo-luddite Treatise on High Tech, Artificial Intelligence and the True Art of Thinking* (2nd Ed.), Berkeley: University of California Press.

Sitkin, S. B., Sutcliffe, K. M and Barrios-Choplin, J. R (1992). "A Dual-capacity Model of Communication Media Choice in Organizations. *Human Communication Research, 18, 4*, 563-598.

Sproull, L., & Kiesler, S. (1986). "Reducing Social Context Clues: Electronic Mail in Organizational Communication. *Management Science, 32, 11*, 1492-1512.

Sproull, L., & Kiesler, S. (1992). *Connections: New Ways of Working in the Networked Organization*, Cambridge: Mit Press.

Steinfield, C. (1992). "Computer-mediated Communications in Organizational Settings: Emerging Conceptual Frameworks and Directions for Research. *Management Communication Quarterly, 5, 3*, 348-365.

Trevino, L. K., Daft, R. L., & Lengel, R. H. (1990). "Understanding Managers Media Choices: A Symbolic Interactionist Perspective. In Fulk, J. and Steinfield, C. (Eds.), *Organizations and Communication Technology*, Newbury Park: Sage Publications, 553-574.

Tushman, M. L and Nadler, D. A (1978). "Information Processing as an Integrating Concept in Organizational Design. *Academy of Management Review, 3, 3*, July, 613-624.

Webster, F., & Robins, K. (1986). *Information Technology: A Luddite Analysis*, Norwood: Ablex.

Weick, K. E (1979). *The Social Psychology of Organizing*, Reading: Addison-wesley.

Weick, K. E (1987). "Theorizing About Organizational Communication. In Jablin, F.m., Putnam, L.l., Roberts, K. H. and Porter, L.w. (Eds.), *Handbook of Organizational Communication*, Newbury Park: Sage Publications, 97-122.

Wellman, M. P., & Wurman, P. R. (1998). "Market-aware Agents for a Multi-agent World. *Robotics and Autonomous Systems, 24, 1*, 115-125.

Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Anti-trust Implications*, New York: Free Press.

TEAM PROCESS CONSTRAINTS: TESTING THE PERCEIVED IMPACT ON PRODUCT QUALITY AND THE EFFECTIVENESS OF TEAM INTERACTIONS

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A focused exploration of research presented at IAIM in 1997, this study applies the structuring of student teams recommended by Mennecke and Bradley (1997), adapts the roles, and extends structure to group meetings. Findings verify the increased team cohesion found by these prior researchers and, in addition, indicate that the use of meeting constraints as well leads to a more satisfying team experience. Recommendations are provided for structuring project teams so that procrastination is minimized and equal contribution to the effort is facilitated.

INTRODUCTION

The goal of this study is to extend the work of Mennecke and Bradley (1997) concerning the impact of structured roles on student team projects. Mennecke and Bradley (1997) address the problems associated with working in project teams for IS student projects:

- Students who choose to engage in group social activities prefer to work alone on projects.
- Teams require higher transaction costs in terms of time to complete the project, communication, and scheduling.
- Teams "procrastinate until the project due date" and "as the pressure increases, group cohesiveness breaks up" (p. 23).

Working with traditional students who lack work experience, they find students unskilled in team process. Therefore, they test structuring roles for project teams, and measuring results after controlling for many confounding variables. While their instruments do not find measures of satisfaction to be higher in the treatment group, they find that structuring roles improved the quality of the projects and improved group cohesiveness. They conclude that the added structure improved team process. They believe that increased use of "e-mail, list serv, chat room" (p. 24) would further improve team process and lower transaction costs.

Mennecke and Bradley (1997) provide some structure by requiring that each student assume one key role within the team. Their findings and presentation of these findings stimulated the current adaptation of the roles. In the current study, students are required to vary assigned roles over the course of the project. Precondition data is gathered, e.g., participation on prior project teams, work experience, preference for working alone or in teams, perceptions regarding the effectiveness of working in teams and transaction costs of team work. Not only are roles structured, but the conduct and scheduling of meetings is structured. Anecdotal evidence suggests that failure to meet throughout the semester and failure to conduct meetings effectively adversely affects team process. Meetings are a major source of team conflict. Further, documentation of team process are made a component of project deliverables and evaluation for the treatment group. After projects are complete but before projects are graded, students complete a questionnaire concerning the team experience as well as open-ended questions concerning the team process. The control or comparison group is another database class in which these team process constraints are not employed but which uses the same syllabus for the course and the same requirements for the database project.

Our objective is to recommend methods for improving student team process, beyond the increased team cohesion demonstrated by Mennecke and Bradley (1997) through the use of structured roles. We want these methods to lead to some degree of satisfaction with the team process. Further, we want to use the team project to teach effective meeting skills.

METHODOLOGY

Students enrolled in two sections of a required course in Database Systems participated in the study. One section applied the treatment described above; the other required team projects but did not structure the team interactions or even describe the possibility of role assignment or use of meeting agendas, action lists, and minutes. At the beginning of the semester, the treatment class is given a description of team process constraints, involving both meetings and structured roles. As recommended by Mennecke and Bradley (1997) in their future research section, extensive use of e-mail is required to facilitate communication and coordination.

- Project teams are to meet at least once per week, beginning with week 2 of the semester. A regular meeting time at the same place, time, day is strongly recommended. Teams may need to meet more than once per week during some phases of the project.

- Each project team member must play one of the three primary roles during the course of the semester and each of the three roles must be designated at each meeting. The three roles are meeting facilitator, scribe, and scheduler.

- Each meeting must have an agenda provided by the meeting facilitator to each team member prior to the meeting. E-mail is recommended for this task. Each meeting must result in an action list designating tasks to be performed, responsibility for the task, and deadline for the task. The first item on every meeting's agenda should be a review of the action list from the prior meeting. Each meeting's agenda should also include formal recognition of the approval of the minutes of the prior meeting. These minutes can be approved via e-mail after all necessary revisions are made. The scheduler should always be on each agenda, reporting on project status against the timetable.

- The scribe must record the minutes of each meeting and these minutes are an essential part of the project deliverables. The minutes must include the following items: members present, members absent, members playing each of the three primary roles, copy of the agenda, detailed notes on discussions/decisions for each agenda item, the action list for the next meeting. The action list for the next meeting must be distributed to each team member via e-mail within two days of the meeting. Minutes must also be distributed to team members for approval via e-mail no more than two days after each meeting.

- The scheduler must contact each team member at least two days prior to each meeting to confirm meeting attendance, reschedule meetings when attendance is problematic, and maintain the project timetable. The scheduler should report the status of the project against the timetable at each meeting. The team may wish for each member to serve as scheduler for two consecutive weeks.

After this description of team process is presented, each member of the class is asked to briefly introduce himself and to indicate good meeting times. Students chose their own team members after these introductions. Students in the control group also chose their own team members.

These project team constraints extend those specified by Mennecke and Bradley (1997, 21), where four roles are defined.

- Presider or Meeting Leader
- File Manager or Project Leader
- Meeting Coordinator
- Intermediary

We employ three roles which are parallel but not precisely equivalent to their first three roles.

- Facilitator
- Scribe
- Scheduler

The facilitator like the Presider or Meeting Leader develops and distributes a meeting agenda and is responsible for keeping the meeting on task. No Project Leader was designated but documentation, a primary responsibility of the File Manager or Project Leader, was the scribe's role for meetings. Project documentation would have been an action list item, assigned by consensus at the meeting. The Meeting Coordinator tasks were filled primarily by the Scheduler. The Scheduler also kept the project schedule or time table. Regularly scheduled weekly meetings were held, so no meeting coordinator needed to call a meeting. The Itermediary role, where a student was assigned to act as the intermediary between the project team and the instructor, was not employed. The roles have many similarities, but perhaps most importantly, students have well defined roles to play in both studies.

However, in this study, students must play all roles whereas roles were assigned for the entire project in the Mennecke and Bradley (1997) study. Our rationale is that students need to learn all three roles and that students who have played a role will tend to be more cooperative with other students playing this role. The major extension to team structure is to specify weekly meetings with an agenda, published minutes, and action list. This structural component should work to prevent procrastination, a major problem with student team projects.

RESULTS

The following research questions are examined through a two-part questionnaire completed at the close of the term project (Appendix A). By analyzing these perceptions by students, we will consider the following research questions:

Q1. Is the tendency to procrastinate reduced through the increased structure of team processes?

Q2. Do the students perceive the use of meeting constraints to be valuable?

Q3. Do the students perceive the assignment of roles to be valuable?

Q4. Do the students in the treatment group experience higher satisfaction with the team process?

We will also consider mitigating factors such as declared work experience, previous project experience within a class, and overall preference for team projects. Finally, recommendations for improving team process for IS student projects will be formulated, applying and building on the work of Mennecke and Bradley (1997). They demonstrated that group cohesion was positively impacted by their treatment but that satisfaction with "group process, satisfaction with the group's project, and group member ratings" (p. 22) were not significantly different in the treatment group.

MITIGATING FACTORS

Age and Experience

The age, number of prior information systems courses, and work schedules of the two groups were very similar. However, the control group, a slightly older group, had significantly more experience in information systems work, and of those who had such experience, the control group had a greater percentage of members who had been on development teams. This IS experience, coupled with development experience, should predispose this group to have a better project experience.

TABLE 1
AGE AND EXPERIENCE

ATTRIBUTES OF AGE AND EXPERIENCE	Control Mean Std. Dev.	Treatment Mean Std. Dev.	T-test *p* value
1. Average Age	29.73 7.71	27.55 8.35	.14
2. No. of prior IS courses	5.1 3.85	4.16 2.87	.35
3. Work full time	33.33%	30%	
4. Work part time	43.33%	45%	
5. Do not work	23.33%	25%	
6. Worked in IS (y/n)	43%	16%	.01
7. If y to #6, part of a development team? (y/n)	35%	8%	.009
8. No. of IS projects completed	2.2 1.47	3.21 1.51	.054

Overall preference for team projects. Students in both the treatment and control group agreed that they like to work on a project team and liked to work alone. The treatment class actually showed a stronger preference for working as a member of a project team, but that preference was not statistically significant compared to the control group. Both groups agreed that projects take more time if completed as a team activity. However, 88 percent of the students agreed with the statement that "Project quality is improved if the project is a team activity." There were no significant differences between the two groups in regard to preference for team projects versus working alone.

PERCEPTIONS REGARDING MEETING CONSTRAINTS

Weekly Meeting Time

The treatment group was required to meet weekly beginning with the second week of the semester. The objective of this constraint was to facilitate incremental work and thus, reduce procrastination. In class, the instructor strongly recommended establishing a regular weekly time and place, so that students could work their schedules around this regularly scheduled meeting.

Students perceived this practice to be highly effective means of preventing procrastination. The mean response to the statement, "Establishing a weekly meeting time helped the team to work on the project throughout the semester instead of as a 'last minute' endeavor," was 4.43 with a .68 standard deviation. The mode was 5.0 or strongly agree.

Agenda

In general, treatment students agreed that "Publishing an agenda for each meeting was valuable," with a mean response of 3.8 and standard deviation of .89. Ten percent of the students disagreed that the agenda was valuable, twenty percent were indifferent, and 70% agreed that the agenda was valuable. Only twenty percent strongly agreed, however. A more focused statement, "Publishing an agenda for each meeting caused us to use meeting time more effective," received a similar response: mean of 3.9 with a standard deviation of .91.

Action List

Treatment students tended to agree that the action list was valuable and that it helped the team stay organized. Agreement was not as strong or consistent concerning the action list's impact on everyone doing his or her fair share. However, only one student disagreed with this third statement. Half the students did find the action list helpful for distributing work equally.

TABLE 2
PERCEPTIONS REGARDING PROJECT TEAMWORK

5= Strongly Agree, 1=Strongly Disagree

	Control Mean, Std. Deviation	Treatment Mean, Std. Deviation	T-test, *p* value
I like to work on a project team.	3.80 1.16	3.75 .97	.84
I like to work alone.	3.60 1.10	3.3 .80	.22
I prefer to do project work alone.	3.20 1.37	2.65 .93	.13
I prefer to do project work as a member of a team.	3.50 1.25	3.90 1.02	.24
Projects take more time if completed as a team activity rather than as an individual activity.	3.10 1.45	2.95 1.32	.81
Project quality is improved if the project is a team activity.	3.10 1.47	3.5 1.28	.36

TABLE 3
PERCEPTIONS REGARDING ACTION LISTS

Statement	Treatment Mean Std. Dev.
Creating an action list was valuable	4.3 .57
Creating an action list helped us to stay organized.	4.4 .68
Creating an action list helped us to make sure everyone did his or her "fair share."	3.85 .93

Minutes

Not surprisingly, minutes were not altogether popular. On the scale of 1-5 with 3 being indifferent and 5 strongly agree, treatment students agreed (mean 3.75, std. dev. 1.07) on their value and agreed (mean 3.65, std. dev. 1.18) that recording and publishing minutes improved communication. Notably, action lists were perceived to be more valuable than minutes.

ROLES ASSIGNMENT

Three statements were designed to assess whether the student perceived playing each of the three roles to be of value. One of the differences with the Mennecke and Bradley (1997) study was that students had to play all roles. Then, the student was asked to assess whether the use of roles improved team process. Finally, students were asked to assess the value of each role. In general, treatment students agreed that playing a role, particularly that of facilitator, had been a valuable experience. They perceived that the use of the three roles improved team process, with the role of facilitator being perceived as improving team process the most. Interestingly, only one student disagreed with each of the seven statements concerning the value of roles.

Perceptions of Impact of Team Process Constraints

Both the control and treatment groups perceived that team skills were improved by the project and that they had learned to use meeting time more effective. Stronger agreement occurred in the treatment group, but differences are not statistically significant (*p*= .41, .36). The treatment group agreed with the statement that the constraints had increased team effectiveness.

Satisfaction with the Project Experience

Mennecke and Bradley (1997) demonstrated that the use of roles increased group cohesiveness. The authors have observed that when students are unhappy with the project results or the experience itself, "finger pointing" occurs and students are unhappy with their group. Therefore, as an assessment of satisfaction, we asked students to agree or disagree with the statement, "I would choose the same team members again." Treatment group students agreed with the statement and were very close to strong agreement Even though the control group should have been predisposed to work well in teams because of their higher percentage of students with work experience and IS development experience, the treatment group actually ended the project more willing to work with their team again.

TABLE 4
PERCEPTIONS REGARDING ROLES ASSIGNMENT

Statement	Mean, Std. Dev.
Playing the role of facilitator was valuable to me.	3.65, .81
Playing the role of scribe was valuable to me.	3.55, .83
Playing the role of scheduler was valuable to me.	3.40, .75
Having a designated scheduler, scribe, and facilitator improved the team process.	4.10, .72
Having a designated scheduler improved the team process.	3.65, .75
Having a designated scribe improved the team process.	3.85, .75
Having a designated facilitator improved the team process.	3.95, .76

TABLE 5
IMPACT OF TEAM PROCESS CONSTRAINTS

Statement	Control Mean, Std. Dev.	Treatment Mean, Std. Dev.
My skill at working on teams has improved as a result of this experience.	3.83 .93	4.05 .89
I learned how to use meeting time more effectively.	3.83 .95	4.05 .69
The project team worked more effectively with the constraints concerning meetings and roles played than other teams on which I have worked which had no team process constraints.	N/A	3.90 .72

TABLE 6
SATISFACTION WITH PROJECT EXPERIENCE

Control Mean, Std. Dev.	Treatment Mean, Std. Dev.	T-test *p* value
3.24 1.41	4.35 .93	.003

SUMMARY OF RESULTS

We posed four research questions:

Q1. Is the tendency to procrastinate reduced through the increased structure of team processes?

Q2. Do the students perceive the use of meeting constraints to be valuable?

Q3. Do the students perceive the assignment of roles to be valuable?

Q4. Do the students in the treatment group experience higher satisfaction with the team process?

In answer to these questions, we found regular, weekly meetings tended to prevent waiting until the last minute. Students did perceive the use of all other meeting constraints to be valuable, and found the action list to be most valuable. Likewise, students perceived the use of roles to be valuable to themselves and to the project team, particularly the role of facilitator. Students in the treatment group would work with the same team again, satisfaction with the team process. Satisfaction with the team process was the strongest difference experienced in the control and treatment group. This finding extends Mennecke and Bradley's (1997) finding that cohesion increased with the use of roles.

STUDENT RECOMMENDATIONS FOR IMPROVING TEAM PROCESS CONSTRAINTS

Recommendations for improving team process constraints further include the following:

- Student comments reveal that changing roles throughout the semester became burdensome. They recommend having everyone play each of the roles for at least one week, then assign the roles for longer durations. Many students found the constant shift in roles confusing.
- Students recommend a midterm project review and submitting weekly team process documentation for feedback and possibly, grading. They would prefer incremental feedback.
- Thirdly, many students recommended a team contract to insure agreement on meeting times, roles, etc.

Some students commented that they found the constraints time consuming and burdensome, but the tenor of the comments was that students had found these constraints effective and used them voluntarily for projects in other courses.

LEARNING CONTENT

The objective of a project is two fold: students learn to work well on project teams and students reinforce course content by actually applying what is learned. Both groups were asked to assess whether or not the project helped them to learn content and thus affected their course grade. Interestingly, both groups perceived that the project had helped learn course content with the treatment group having a slightly stronger perception of learning content. However, neither group agreed that exam scores had been improved by their project work. This statement may confound satisfaction with the grade on exam scores with learning content through the project.

TABLE 7
LEARNING CONTENT

Statement	Control Mean Std. Dev.	Treatment Mean Std. Dev.	T-test *p* value
The project helped me to better understand topics and problems in the database course.	3.97 1.16	4.35 .59	.12
My participation on the project team improved my exam scores.	3.3 1.12	3.45 .89	.42

LIMITATIONS OF THE STUDY AND CONCLUSIONS

This study is primarily a qualitative study further exploring and applying the work presented by Mennecke and Bradley (1997). The two classes involved in this study are insufficient for reaching broad, general conclusions. While assumptions of randomness are not met, we have used statistical comparisons of groups as some indication of whether differences are significant. Because of the difficulty of comparing project results when two instructors assign the grade and when team process was a major grade component in the treatment group but not the control group, no objective measure of project quality has been used at this time.

The use of meeting constraints, particularly regularly scheduled weekly meetings and action lists, were perceived as valuable as was the use of roles. Regularly scheduled meetings did tend to reduce procrastination. The facilitator role was perceived as particularly important. Significantly, students operating under team process constraints were more willing to work together again, thus these constraints served to reduce the dissatisfaction often associated with student project teams. As an instructor, dealing with the students in the treatment group was much pleasanter because only two team members came to the instructor with team problems during the entire semester. As a result of this experiment, we recommend the use of meeting constraints and roles along with the following modifications:

- mid-term, project review. Teams review each other's work, then each team presents the project in class
- weekly submission of the action list along with results of prior week's action list and minutes of the weekly meeting
- each student plays each role at least one, then roles are assigned for the semester
- optional contract, with a discussion of possible contract points.

As Mennecke and Bradley point out, "Research of this type is always confounded by extraneous factors that cannot be eliminated" (p. 23). To some extent, what we have accomplished is a structured trial-and-error. But we have demonstrated that certain team process constraints do seem to make a positive difference for team process, student satisfaction, content learning, and instructor management of project teams.

REFERENCES

Mennecke, B. and Bradley, J. (1997). Making project groups work: The impact of structuring group roles on the performance and perception of information systems project teams. *Proceedings of International Academy for Information Management.* (12), 19-24.

McKinney, K and Graham-Buxton, M. (1993). The use of collaborative learning groups in the large class: is it possible? *Teaching Sociology*. (21), 403-408.

Putnam, L.L. (1979). Preference for procedural order in task-oriented small groups. *Communication Monographs* (46), 193-218.

Sadler, C. (1994). Guidelines for group work. *National Teaching and Learning Forum* (3:6), 8-11.

APPENDIX A
TEAM PROCESS EVALUATION

Name______________________________

Part 1: Using the following scale, please evaluate the following statements. Please mark the accompanying Scan-tron form. Please record your name on the Scan-tron form as well as this form.

A. Strongly Agree *B. Agree* *C. Indifferent* *D. Disagree* *E. Strongly Disagree*

1. I like to work on a project team.

1. I like to work alone.

2. I prefer to do project work alone.

3. I prefer to do project work as a member of a team.

4. Projects take more time if completed as a team activity rather than as an individual activity.

5. Projects take less time if completed as a team activity rather than as an individual activity.

6. Project quality is improved if the project is a team activity.

7. Establishing a weekly meeting time helped the team to work on the project throughout the semester instead of as a "last minute" endeavor.

8. Publishing an agenda for each meeting was valuable.

9. Publishing an agenda for each meeting caused us to use meeting time more effectively.

10. Creating an action list was valuable.

11. Creating an action list helped us to stay organized.

12. Creating an action list helped us to make sure everyone did his or her "fair share."

13. Recording and publishing the minutes of meetings was valuable.

14. Recording and publishing the minutes of meetings improved communication.

15. I learned how to use meeting time more effectively.

16. My skill at working on teams has improved as a result of this experience.

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17. The project helped me to better understand topics and problems in the database course.

18. My participation on the project team improved my exam scores.

19. Playing the role of facilitator was valuable to me.

20. Playing the role of scribe was valuable to me.

21. Playing the role of scheduler was valuable to me.

22. Having a designated scheduler, scribe, and facilitator improved the team process.

23. Having a designated scheduler improved the team process.

24. Having a designated scribe improved the team process.

25. Having a designated facilitator improved the team process.

26. The project team worked more effectively with the constraints concerning meetings and roles played than other teams on which I have worked which had no team process constraints.

27. I would choose the same team members again.

Note: Questions 8-15, 20-27 were omitted in the comparison class questionnaire. A question regarding meeting frequency was added.

Part 2: Please answer the following questions in the space provided.

1. Number of prior information systems courses at KSU and other schools _____

2. Age ______

3. Work full time? ______ Part time?______

4. Number of other courses taken this semester:_______

5. Have you ever worked in information systems? _____

6. If so, have you been part of a systems development team? _______

7. If you answered yes to question 5, please describe your information systems work experience briefly.

The following questions apply to information systems course work only:

1. How many information systems projects have you completed?_______

2. How many projects allowed you to select your own team members?______

3. If team members were assigned, what was the basis for assignment?

4. On how many projects were project teams asked to follow certain guidelines to improve team process? Please describe team process guidelines for prior project teams.

5. If guidelines have been given, which guidelines did you find effective?

6. What suggestions would you make to further improve team process for the database project?

7. If you do not prefer to work on a project team, please explain this preference.

Other comments?

TEACHING INFORMATION SYSTEMS DEVELOPMENT (ISD) USING "VIRTUAL TEAM" PROJECTS

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ABSTRACT

In this paper, we discuss our experiences in designing and implementing a "virtual team" systems development project that enabled us to incorporate the different types of knowledge relevant to teaching Information Systems Development (ISD) and the different stages of learning applicable to students in institutions of higher education. We outline some of the unique advantages as well as potential pitfalls that professors interested in adopting this project structure should be aware of. We also provide a framework that can guide the design and evaluation of ISD courses.

INTRODUCTION

With the rapid developments in electronic communication and computer technologies, there have been many predictions and much hype about how these technologies will revolutionize the educational processes of universities in different disciplines (e.g., in business administration). However, based on a preliminary analysis of technology initiatives in business schools, Leidner and Jarvenpaa (1995) concluded that "initial attempts to bring information technology to management education follow a classic story of automating rather than transforming... In the absence of fundamental changes to the teaching and learning process, such classrooms may do little but speed up ineffective processes and methods of teaching.

In this paper, we discuss our attempt to *transform*, not just automate, the delivery/ facilitation of our classes using an innovative project design requiring students to work in "virtual systems development teams. Specifically, we cover the theoretical perspectives that have informed our thinking on teaching information systems development (ISD), the objectives guiding the project design, the tangible and intangible benefits students have experienced (and reported to us), potential pitfalls in conducting such projects, and finally, future directions.

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THEORETICAL PERSPECTIVES

Our Own Backgrounds

Human action often reflects the theories held by the concerned actor regarding the domain of application (Argyris and Schon, 1978). By extension, this implies that the theoretical assumptions and beliefs that an academic holds dear, informs not only how the person conducts research, but also how he/she teaches or how he/she believes a course must be taught. We (the three co-authors) discovered how similar our concerns and aspirations were regarding the classes we were teaching, even though we were based in different universities in two different countries. We could trace our common set of concerns to our similar (though not identical) meta-theoretical and epistemological commitments in our individual research programs, which in a broad sense may be characterized using terms such as interpretive, constructivist, sociotechnical, process-oriented, non-deterministic and emergent, conceptual, and action-oriented[1] (Markus and Robey, 1988; Lee, 1991; Orlikowski and Baroudi, 1991). On self-reflection, we found that we enacted (and sought to further integrate) these beliefs in our classrooms as we taught ISD to our students.

Based on our exposure to and commitment to socio-technical thinking (Mumford, 1995) and interpretivism (Orlikowski and Baroudi, 1991), we were convinced that systems design and implementation should not be viewed as a technical activity alone, but as an activity that is simultaneously social and technical (Davis et al., 1992). Rather than considering the systems requirements as unambiguously known, we chose to view requirements analysis as the most significant road-block in designing and implementing a successful information system. Having adopted this view, we could see why Churchman and Schainblatt (1965) saw *mutual understanding* as an essential ingredient of successful systems implementation. Thus, we needed to incorporate some mechanism in our classes for future systems designers (i.e., our students) to develop skills of communicating and interpreting symbols. These skills would enable them in their future role as systems designers to attain a state of mutual understanding with other relevant social groups (say, the users) whose members did not share the designers' frames of reference, and vice versa.

Types of Knowledge

We also realized, drawing on our epistemological beliefs, that the practice of information systems development (ISD) requires different types of knowledge, some of which were being consistently under-emphasized within the traditional models of IS teaching. Drawing on the work of Rockart and Scott Morton (1975), Lee (1991), Hirschheim and Klein (1989), and (most significantly) Astley and Zammuto (1992), we came to identify three broad forms of knowledge in the domain of ISD:

(1) *Facts and definitions* are the presumed truths and objective descriptions of technologies and concepts. Straightforward answers to the following questions, for example, would be included in this category.

What is a DSS?
Define generalization/specialization.
State the advantages of a "data-oriented approach to systems design over a "process-oriented approach.
When is a relation said to be in BCNF?

In imparting this kind of knowledge, the role of the professor is to act as a provider and/or conduit of information. Mastery of such knowledge by students involves more "memorization than "understanding.

(2) *Knowledge of technology and techniques* refers to the instrumental or "how to knowledge that allow students to solve certain class of problems that fit the structure or utilize the easily apparent capabilities of the tools and techniques. In a sense, the role of the professor imparting this type of knowledge is to act as an "expert, who would illustrate the technology and techniques through the use of "paradigmatic problems which can serve as problem-solving templates for students. Examples of technology/ techniques knowledge include:

When you wish to represent a relationship between a many-to-many relationship and another entity, use aggregation.
To transform a 2NF relation to 3 NF, remove the transitive dependencies.
The PERT and GANTT charts can be drawn in Microsoft Project in the following way...

It is important to note that this knowledge goes *beyond* definitions, since the above statements are not very valuable unless the student actually learns to use the knowledge contained in the statements for problem solving. Also, it is worth mentioning here that the traditional educational model assumes that by providing students with "drills of solving simplified problems that fit the techniques/technology, they would become capable of using this form of knowledge in a different context (i.e., the "real world).

(3) *Social knowledge:* As mentioned above, owing to our sociotechnical orientation, we recognized the importance of not only the above forms of knowledge but also another category of knowledge, which we call "social knowledge. This form of knowledge, in our context, refers to a practicing systems analyst/designer's understanding of social phenomena associated with ISD, and the knowledge that would enable him/her to explain and predict behaviors of social entities (organizational units, different stakeholders, etc.) *Social knowledge* can further be divided into:

3a) Propositional knowledge: This type of knowledge is instrumental in nature and focuses on the means that lead directly to some pre-defined ends in the social arena. Knowledge having the structure: a) If <specific problem>, then <specific solution>; or b) outcome = Function (factor 1, factor 2,...., factor n) may be viewed as propositional. This type of knowledge is most popular since it is *perceived* to satisfy the usefulness/applicability in the "real world criteria on superficial examination. Teaching propositional knowledge requires the teacher to play the role of an expert who articulates well-defined rules and then illustrates the rules through carefully formulated applications (real-world cases simplified to fit the knowledge) or specific success stories arising from the use of such knowledge. Examples of such knowledge include:

> Communication leading to mutual understanding is the key to effective information requirements analysis.
>
> A prerequisite to successful systems implementation is a "fit between the technology being implemented and the surrounding social system.

3b) Conceptual knowledge: This refers to concepts that allow us to see the world in different ways. This knowledge is not directly applicable, but needs to be merged with a specific context and processed in the mind to derive implications for action. In other words, conceptual knowledge needs to be converted to instrumental knowledge by the knowledge users themselves before it can be used. It is our belief that most issues relating to ISD are so complex and so dependent on the unique context, that it is impossible to create universal propositions or techniques that are directly applicable in any context. In such a circumstance, conceptual knowledge becomes extremely valuable. Teaching conceptual knowledge involves acting as a facilitator in the process of exploring abstract concepts and theories jointly with the students. The objective of teaching conceptual knowledge is not to provide "information" or a "set of rules," but to help each student create (possibly) unique skeletal non-deterministic conceptual schema in his/her mind, or to assist in the integration of a new set of concepts in his/her existing schema. As students gain experience in the "real world," they iteratively modify their schema, and add more "flesh" to the skeletal framework. Eventually, they become "experienced professionals," having developed a very rich schema that is based on the conceptual knowledge fundamentally gained in school but enriched through reflective practice.

Topics such as the Leavitt's diamond model of organization, social construction, the hermeneutic circle, metaphor of "text to understand action, etc., are examples of conceptual social knowledge that could enable students to design better systems (through better information requirements elicitation) and to implement systems more effectively.

3c) Finally, we discuss *symbolic knowledge*. This refers to two related types of competencies:

The knowledge that is used to legitimize actions/decisions: As Information Systems professors, we must recognize the possibility that our students go to work in a world that is governed less by principles of technical rationality and more by power and politics. If such is the case, then access to (and application of) symbolic knowledge becomes very critical to the success of our students. In a political work environment, knowledge contained in privileged sources (such as Harvard Business Review, article by Bill Gates or James Martin, etc.) becomes important not because of their rational and conceptual merits necessarily, but because of the retrospective justification that such sources can provide for a chosen course of action.

The use of/interpretation of symbols: Perhaps, a different but more relevant aspect of symbolic knowledge is that to be an effective participant in ISD, it is important to develop the skills for using and interpreting symbols (utterances, text, pictures, etc.) in an effective manner (e.g., Sarker and Lee, 1999).

As IS researchers interested in social analysis, our exposure to the tradition of symbolic interactionism allowed us to see the importance of this form of knowledge in ISD. From this perspective, the role of the professor involved in the education of students who will work in the real world of Information Systems would be: 1) to point to sources of information, vocabulary, rhetoric, methodologies, and appropriate symbolism that are considered legitimate (or are valued) in relevant social groups; 2) to act as a linguistic guide who would sensitize students to the importance of professional vocabulary, rhetoric, and other appropriate symbolic communication; and 3) to provide students with an opportunity to practice and improve their application of symbolic knowledge.

Based on the ideas presented above regarding the different types of knowledge relevant in ISD (including implementation), we concluded that any ISD class should be designed in a way so as to incorporate all of the above types of knowledge in a balanced manner.

Stages of Learning

We also recognized that learning is not a one shot phenomenon, but actually involves a series of analytically separable steps. While there are a number of models on learning, for this paper, we adapt Rockart and Scott-Morton's "general learning model (1975, p. 20) that was proposed to help understand the learning process in higher educational institutions.

According to this model, learning occurs in four progressive stages:

Acquisition in this stage, the learner is exposed to (and asked to remember) basic facts and definitions.

Embedding in this stage, the student thinks through facts, skills, and processes learned, and applies what he/she has learned in simple applications.

Integration in this stage, "the student moves from the rote acquisition of material to its incorporation and subjugation into more global conceptual structures (p. 21).

Testing in this stage, the student tests the implications of what is learned in new and realistic contexts. This also provides an opportunity to revise the theories of action the student may have developed (Argyris and Schon, 1978) in the earlier stages of learning.

We could see that most ISD classes in universities (at least the ones that we have attended) do not consciously lead (and in most cases, do not even attempt to lead) a student through the four stages of learning suggested in the "general learning model. We wanted to make a deliberate attempt to incorporate all four stages in our course.

To summarize our discussion, having recognized the need for a more comprehensive view on ISD courses, we wanted to design a course that would span the different types of knowledge (facts and definitions, knowledge of technology and techniques, propositional social knowledge, conceptual social knowledge, and symbolic social knowledge) and the four stages of learning (acquisition, embedding, integration, and testing).

COURSE DESIGN

Objectives

Specifically, the design objectives for our ISD course were the following:

Expose students to the complexity of *real-world* systems development and implementation.

Illustrate the *socio-technical nature* of information systems techniques and technologies based on computer sciences, and design principles/guidelines based on social sciences

Adopt a *balanced approach* towards the various *forms of knowledge* and the different *stages of learning*

Course Design

The ISD-related courses that we designed at our two universities consisted of lectures, assignments, and a virtual team project. The lectures and assignments were modeled on the traditional modes of teaching ISD concepts and skills, focusing primarily on facts and definitions, knowledge of technology and techniques, and propositional social knowledge. Also, the lectures and assignments were geared toward the first two stages of the learning model (acquisition and embedding). The virtual team project had two main goals: 1) to help the student pass through the remaining two stages of learning (integration and testing) regarding technology and techniques by providing a real context for application that was not artificially bounded, and 2) to simultaneously facilitate the embedding, integration, and testing of social knowledge, especially conceptual knowledge and symbolic knowledge.

It is useful to point out at this stage that, while *in principle*, the traditional face-to-face team projects can also achieve the two goals stated above, we believe that virtual team projects are likely to be more effective in achieving the goals. The time/space separation in a virtual context results in the lack of shared norms regarding collaboration among the team-members and interaction with the client. Consequently, complexities arising from social factors tend to get magnified, and thus, a majority of team-members are forced to reflect on the issues, and learn to creatively apply social knowledge to solve or at least mitigate the problems. In contrast, in face-to-face teams developing systems having information requirements of comparable (low) complexity, many of the social complications do not surface or can be dealt with intuitively by team-members without deliberate application of social knowledge. Thus, students working in face-to-face teams for their term projects, focus primarily on the application of technology/techniques related knowledge, and fail to appreciate the importance of different types of social knowledge (especially, symbolic knowledge) that could be extremely valuable during the development of large scale information systems for complex organizations (with different stakeholder groups who do not have shared frame of reference) or when working in globally distributed teams (Jarvenpaa and Leidner, 1999) for systems development.

In fact, in our experience, traditional face-to-face student team-members are far more concerned about other team-members not doing their share of work (a concern that is less important in the "real world), than about understanding social issues such as user-analyst or analyst-developer relationships/communication patterns, developing/clarifying systems specifications for individuals not having a shared frame of reference, and developing strategies for coordinating and managing relationships among members of the ISD team.

In the rest of this section, we provide a description of the virtual team project. We focus on the project, since it was our primary vehicle for rectifying (what we saw as) the limitations of traditional courses in ISD. We felt that a virtual team project would be helpful in reflecting the reality of today's geographically separated systems development teams. Also, because of the time-space separations among team-members in this project, they would be forced to confront problems of time coordination and lack of shared frame of reference, which would, in turn, enable them to acquire/internalize social knowledge (especially conceptual and symbolic knowledge) in addition to the other forms of knowledge that they would acquire through more traditional mechanisms such as lectures and assignments. In addition, since students would be building (over the entire semester) prototypes for real businesses with actual information problems that did not neatly fit into the textbook templates, they would have to go through the latter two stages of learning over the course of the project.

In our specific context, the virtual teams were comprised of students from two different North American universities working collaboratively to formulate a business information systems problem, converting it into a (database) systems design, and then developing a working prototype. More specifically, the participants were students enrolled in Information Systems courses at two large North American Universities, one based in Canada (which we call UA) and the other in the U.S. (which we call UB). Typically, each virtual team consisted of 4-5 "internal" or "local" group members who were matched with 4-5 "external" or "remote" members from the other university. Thus, each virtual team consisted of about 8-10 members drawn almost equally from UA and UB. The projects lasted for about 14 week-long semesters.

The task assigned to each virtual team was to define, design and develop an information system for a "real" organization. The UA members of each virtual team acted as "business systems analysts and were responsible for going into an organization and identifying a "problem situation that they believed needed resolution using a computer-based information system.[2] They were then supposed to create a rich narrative of the problem in the form of an "information requirement document (IRD) which had to be then transmitted to their counterpart external team members at UB who were acting as "systems designers.[3] In addition, UA members were required to provide a preliminary design of the user-interfaces that would be preferred by the organizational clients. The UB members of each team were then responsible for creating a detailed systems design (including an Entity-Relationship or E-R diagram) and a working prototype of the database system. Finally, UA and UB team-members were to make a joint presentation (using videoconferencing technology) of their entire project, including the working prototype. In Table 1, we list the participants in this project. Next, in Table 2, we summarize the different events of the project with the associated time-lines.

TABLE 1
PROJECT PARTICIPANTS

Main Participants	*Brief description*
UA members	Members of virtual teams who were students at UA. Primarily involved in interacting with the clients and defining information and end-user interface requirements
UB members	Members of virtual teams who were students at UB. Primarily involved in logical design and implementation of the system based on specifications created by UA members in their teams.
PA	Professor facilitating the virtual teams from the UA side
PB	Professor facilitating the virtual teams from the UB side.
Companies (each team interacted with a different company)	Located in the same city as UA. UA members interacted with company representatives to define the systems requirements.

TABLE 2
FORMAL PROJECT STRUCTURE

Phase of the Project	*Timeline (in weeks)*	*Event Descriptions*
Phase I: Formation of the team and creation of work plans	Week 0 to week 4	Event 1: creation of the virtual team by PA and PB Event 2: Selection of organization by UA members for which the virtual team would develop a system Event 3: introductory videoconference #1 Event 4: completion of project proposal by UA members
Phase II: Defining the business problem	Week 5 to week 8	Event 5: Completion of the Information Requirements Document (IRD) by UA members Event 6: Videoconference #2 to clarify the contents of IRD
Phase III: System design, development and delivery	Week 9 to week 14	Event 7: Completion of conceptual/logical design by UB members Event 8: Completion of user interfaces by UA

		Event 9: Prototype delivery by UB members and joint presentation in videoconference #3

BENEFITS DERIVED FROM THE PROJECT

Perceptions of Students

The following representative quotations of students after completing the project provide evidence regarding the benefits that students perceived (emphasis added).

QUOTATION 1. *Overall this was a true learning experience.* ***Our group got to see what it takes to complete a project with a group thousands of miles away.*** *We learned that* ***time management*** *was essential,* ***and learning about team members' background early*** *in the project is crucial in completing the project. Some* ***technical skills*** *that we learned were* ***ICQ, Access, Database coding, interactive communication through videoconferencing and web-board.*** *We discovered that* ***each culture has its own customs and one must adapt to those differences*** *if the group is to work well. The most important thing we learned was* ***communication skills.*** *We learned that communicating effectively with your (virtual) counterparts is crucial, and* ***if communication breaks down then there is little chance for success.*** *Fortunately for us, we were able to cross all cultural and communication barriers and put it all together through team effort.*

QUOTATION 2. *I think that as companies grow and expand throughout the world, the use of virtual teams will become vital. The concept of using virtual teams is highly beneficial as it prepares us to deal with other people in other locations. I learned that MS Access is a powerful tool. I learned to manipulate it through SQL and through Visual Basic.* ***But most importantly, I think I learned to deal with other people in multiple contexts and in different situations...*** *this project enabled me to see that* ***cooperation is the key ingredient to a successful project.***

QUOTATION 3. *In my opinion, the experience of this project has been outstanding. The collaboration* ***really gave exposure to the workings of a "real world" project,*** *from start to finish, with all* ***the technical, organizational, and human challenges*** *one would expect in a business scenario.*

QUOTATION 4. *At first, I was hesitant to accept that this local-remote idea would be beneficial to the project but after completing the project, I realize it has been. We have learned database systems and* ***we have also gained an unusual and unique experience.*** *We have created a database system and application without ever meeting (in person) the customer. I have* ***learned many technical lessons.*** *Primarily, how to produce a product that meets the expectations and requirements of someone else. In most class projects that I have worked, we have had to develop our own project.* ***Developing a project for a remote group mimics the real world much more accurately.***

Our (The Professors') Interpretation

The four quotations capture a number of lessons that students took away from the course. Most importantly, the students had an opportunity to *integrate* and *test* their knowledge about technology/techniques (SQL, VBA, EER Modeling, DSS design, etc. that were covered in the lectures) in a new real-life context, where the problems did not necessarily match the structure of the examples covered through lectures and assignments. This allowed the students to become significantly more competent in the technical domain.

Another important issue that is reflected in virtually every quotation is that the students could appreciate the socio-technical nature of ISD. Such appreciation is extremely difficult to attain just through lectures and assignments, or by stating the importance of sociotechnical thinking by “rote in propositional form. The opportunity to innovatively “try out some of the conceptual knowledge contributed to the internalization and enrichment of the students' conceptual schema, thus advancing a student from a novice towards becoming an expert.

Similarly, the students participating in the project could comprehend the importance of dealing with gaps in communication, culture, and contexts, the lack of shared frames, and complexities in working across time zones. Their comprehension was considerably more profound than what could be expected from their attending lectures where an instructor droned “propositions such as “Communication is necessary for successful ISD.

Finally, the level of competence in the use of symbols gained by participants is beyond question, and this is evident from their careful use of “evocative [4] and “referential [5] symbols (Couch, 1996). Students also appeared to have realized the importance of building team norms for guiding argumentation and other forms of communication through the life-time of the project.

On a more practical note, we received higher teaching evaluations (and/or more positive comments) for course offerings that involved the virtual team project, which reflected higher students satisfaction with the learning process (and perhaps, partially, the novelty of the experience). Students were exposed to a number of communication technologies and formed long-term professional networks with local members, and in some cases, with remote members. Also, students who participated in our project had something interesting to say during campus job interviews. For example, in response to an interviewer's question "Can you tell me about any challenging project you have done in your MIS classes? students were able to enthusiastically respond and narrate their experiences and lessons learned. In fact, we have received *very* positive feedback from recruiters who visited our universities. For example, the lead recruiter of a reputed insurance company in the US, sent the following e-mail to one of the co-authors after interviewing students who had participated in the project:

> *...One of the interview questions I always ask is what the student's favorite class is. Almost every [university name] person I interviewed mentioned your [course name] class. That speaks volumes for the things you are doing with your students and I'm very much looking forward to seeing some of this first hand on my next visit.*

Not surprisingly, some employers have sought and actually hired our students based on (primarily) this unique experience of working in virtual teams.

POTENTIAL PITFALLS

We hope that the reader would agree that there was significant value addition achieved through the IT-enabled change in the way the ISD skills were taught as part of our "teaching experiment. However, we hasten to add that benefits came at a cost. The project drained resources (our research time, as well as department funds used for travel and videoconferencing). In addition, problems encountered in the design, development, and implementation were open-ended; thus the professors as well as the teaching assistants had to work much harder and be more closely involved with each team's project. Sometimes technologies did not work. For example, the videoconferencing equipment did not function for several hours on a Saturday with all students waiting impatiently for their team's turn. The likelihood of students being frustrated was extremely high, and this put severe stress on us, the professors, who, unfortunately, have to sometimes worry about teaching evaluations. Students appeared to get frustrated with the facts that:

> Videoconferences were held on Saturdays, due to schedule conflicts of different students/facilitators, and limited availability of videoconferencing facilities.
>
> The local and especially remote members were often perceived to be unresponsive and uncooperative, and technologies were not available all the time (e.g., Web-board was down for few hours).
>
> Sometimes, from the point of view of the UB members, the UA team-members, in their effort to impress the organizational clients, provided UB members with unrealistic specifications and deadlines. Likewise, UA team-members felt that UB members were technically inept, and were not putting in their best effort.
>
> There was limited guidance available from the teaching assistants regarding technical problems encountered in implementing some features requested by users
>
> Remote team-members had different/incompatible schedules (In fact, we deliberately did not align the UA and UB course structures completely in order to retain some of the complexities of real-world collaboration between two companies with different goals, priorities, and schedules).
>
> There were uncertainties with respect to the outcome of their project (and grades).

Finally, with all the stress experienced by students, teaching assistants, and the facilitators (i.e., the co-authors), there was always a possibility of a breakdown in relationship among the different parties involved, especially among the three co-authors coordinating the project. While we were fortunate in this regard (i.e., we did not experience breakdowns amongst us), and received excellent (much higher than usual) teaching ratings and seemed to have earned the respect of many perceptive students, we do feel that colleagues considering such projects should be aware of potential problems and develop contingency plans as part of the project design to mitigate negative effects if things do go wrong.

CONCLUSION

We believe that our model for teaching ISD using lectures, assignments, and virtual team-projects can be effective in delivering a course that holistically incorporates the types of knowledge and stages of learning. We have designed a framework[6] (Appendix I) based on the theory discussed in this paper. We hope to refine it and convert it to an instrument that can facilitate the evaluation of effectiveness (as perceived by the students) of the different elements of our ISD course in Spring 2001 the semester when we plan to run this project next between a university in the US and a Scandinavian university. In other words, we would like, as part of our next step, to "objectively validate our claim that our course design actually integrates the different types of knowledge and encompasses the four stages of learning. In addition, we would like to evaluate the incremental contribution of the "virtual team project over a traditional ISD "team project (based on the experiences of a "control group in the following semester when we do not run the "virtual team project).

To conclude our paper, we would like to enthusiastically invite members of the IAIM community to incorporate similar strategies in their teaching, which *we think can be very rewarding and fulfilling to the teacher as well as the students*. However, we must add a strong word of caution *the project requires a great deal of planning and effort in order to have a chance to succeed*. In addition, absolute trust and respect (and perhaps friendship) is needed among the professors facilitating such complex projects to manage the ups and downs. *In the absence of trust and respect, the project is likely to be run into trouble* during the term, with disastrous consequences in terms of the concerned faculty members' reputation and teaching evaluations.

ENDNOTES

1. Seeking to closely integrate research and practice.

2. THIS WAS AN ATTEMPT [illegible] MEMBERS [illegible] COURSE TO FOCUS ON ANALYSIS OF REQUIREMENTS FOR MIS AND DSS.

3. THE SYSTEMS DESIGNERS IN OUR CONTEXT ARE STUDENTS FOCUSED ON DATABASE SYSTEMS DEVELOPMENT SINCE THE COURSE IN WHICH THEY WERE ENROLLED WAS ON DATABASE SYSTEMS.

4. Evocative symbols are directed towards developing social solidarity.

5. Referential symbols denote objects, events, and sequences referred to during communication and are useful in coordinating communication processes.

6. The framework is an enhancement of Rockart and Scott Morton's "Learning Matrix.

REFERENCES

Argyris, C. and D. A. Schon (1978). *Organizational Learning: A Theory of Action Perspective*. Reading: Addison-Wesley.

Astley, W. G., and R. F. Zammuto (1992). "Organization Science, Managers, and Language Games. *Organization Science*, 3, 443-460.

Churchman, C. W., and A. H. Schainblatt (1965). "The researcher and the manager: A dialectic of implementation. *Management Science*, 11, 69-87.

Couch, C.J. (1996). *Information Technologies and Social Orders*. D. R. Maines and S. Chen (eds.), New York: Aldine de Gruyter.

Davis, G.B., Lee, A.S., Nickles, K.R., Chatterjee, S., Hartung, R. and Y. Wu (1992). "Diagnosis of An Information System Failure: A Framework and Interpretive Process, *Information And Management*, 23, 293-318.

Hirschheim, R., and H. Klein (1989). "Four Paradigms of IS Development, *Communications of the ACM*, 32, 1199-1216.

Lee, A. S. (1991). "Integrating Positivist and Interpretivist Approaches to Organizational Research," *Organization Science*, 2, 342-365.

Jarvenpaa, S. L. and D. E. Leidner (1999). "Communication and Trust in Global Virtual Teams, Organization Science, 10, 791-815.

Leidner, D. E., and S. L. Jarvenpaa (1995). "The use of information technology to enhance management

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school education: A theoretical view, *MIS Quarterly*, 19.

Markus, M. L., and D. Robey (1988). "Information Technology and Organizational Change: Causal Structure in Theory and Research, *Management Science*, 34 (1988), 583-598.

Mumford, E. (1995)."Creative Chaos or Constructive Change: Business Process Reengineering versus Socio-Technical Design, *Examining Business Process Re-engineering: Current Perspectives and Research Directions*, G. Burke and J. Peppard (Eds.), Kogan Page, 192-216.

Orlikowski, W.J., and J. J. Baroudi (1991). "Studying Information Technology in Organizations: Research Approaches and Assumptions, *Information Systems Research*, 2,1-28.

Rockart, J. F., and M. S. Scott Morton (1975). *Computers and the Learning Process in Higher Education*, New York: McGraw Hill.

Sarker, S., and A. S. Lee (1999)."IT-enabled Organizational Transformation: A Case Study of BPR Failure at TELECO," *Journal of Strategic Information Systems*, 8, 83-103.

APPENDIX I
A FRAMEWORK FOR EVALUATION

Type of knowledge with examples	Role of the professor (and IT)	Component of class design	Acquisition	Embedding	Integration and generalization	Testing in new situations
FACTS AND DEFINITIONS What is a DBMS? Define generalization/specialization State three advantages of the data-oriented approach. A relation is in BCNF if every determinant is a candidate key.	Professor provides information The Role of IT is to aid in information dissemination	Lectures				
		Individual assignments				
		Team-project				
		"Virtual team projects				
KNOWLEDGE OF TECHNOLOGY/ TECHNIQUES When you wish to represent a relationship between a many-to-many relationship and another entity or relationship, use aggregation. To transform a 2NF relation to 3 NF, remove the transitive dependencies. The PERT and GANTT charts can be drawn in Microsoft Project in the following way...	The role of a professor is to "teach a student *how to* use the technology/ Technique, and illustrate it with paradigmatic examples The role of IT is to serve as the scratchpad for students to try out different solutions and improve their understanding	Lectures				
		Individual assignments				
		Team-project				
		"Virtual team projects				
SOCIAL KNOWLEDGE PROPOSITIONAL Communication leading to mutual understanding is the key to information requirements analysis A prerequisite to successful database design is to develop the conceptual model based on the views of the different stakeholders (in the external schema) Communication leading to mutual understanding is the key to successful project management	The role of the professor (an "expert) is to articulate these ideas clearly and help students remember the propositions (as responses to certain stimulus) The role of technology may be to aid the dissemination and periodic testing of the propositions learned by students.	Lectures				
		Individual assignments				
		Team-projects				
		"Virtual team projects				
SOCIAL KNOWLEDGE CONCEPTUAL The Leavitt's diamond model of organization, Social construction; the hermeneutic circle; metaphor of "text to understand action, etc. Expanded aspects of propositional knowledge	The professor acts as a "facilitator in exploring abstract concepts and theories jointly with the students, and helping to create (unique) skeletal non-deterministic conceptual schema in students' minds.	Lectures				
		Individual assignments				
		Team-project				
		"Virtual team projects				
SOCIAL KNOWLEDGE SYMBOLIC Participation in a real virtual team systems development project. Using videoconferencing (novelty) Skills related to reading and displaying communication symbols	A professor's role is to act as a guide in the use of language and other symbols he/she sensitizes students to political realities of the workplace, also acts as an organizer of a forum for students to practice their "professional vocabulary and rhetoric in presentations/ argumentation.	Lectures				
		Individual assignments				
		Team-project				
		"Virtual team projects				

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INTEGRATING PROJECT MANAGEMENT INTO IS CURRICULA

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ABSTRACT

We investigate issues of integration with regard to project management and limited course curricula. In particular, we note that the evolution of fast-track professional master degrees in Information Systems has had a profound impact on the quantum, in terms of relevant subject matter delivery, that the instructor that can reasonably impart in a focussed environment. We therefore reflect on viable alternatives, id est other subjects, and note that there is considerable professional support for subject integration in IS, both in a holistic sense and with regard to project management. We argue that this integration could be achieved by modestly realigning relevant subjects in order to cover overlapping areas thereby improving on completeness of delivery.

INTRODUCTION

Project management is regarded as an essential component in the Information Systems curricula. Indeed most undergraduate/postgraduate IT/IS courses offer industry-targeted project management courses. While this is fine in itself, we should ask ourselves whether what we are teaching is of any benefit to the student and future employers. Can we really afford to let them loose into "the real world and expect them to come up to speed in minimum time with such focussed, discipline-oriented approaches?

Most authors seem to be in agreement that project management is really the culmination of the interaction between several disciplines (D'Herbemont, Cesar 1998, Lientz, Rea 1998, Meredith, Mantel 2000). A successful project manager realises this and is able to draw from a variety of learned skills. A clear and readily accessible example can be seen at the Systemation website, where project management is broken down into various topics each requiring separate tuition.

Information Systems majors have a particular advantage, since they usually enjoy a closer synergy with business-oriented faculties than other majors. Usually they are taught in business faculties where a a good deal of supporting material (in terms of peripheral subject matter) is readily available.

The authors have taught project management for many years, in different environments, and for different expected outcomes. We note, however, that since the introduction (in Australia at least) of fast paced MIT, MIS and IT/IS vocational degrees, project management seems to have become a "child lost in the wilderness . Students emerging from a "one subject encounter (amounting to about 24 to 28 hours of lecture-time and 12 to 14 hours of tutorial/lab-time) with project management cannot be expected to possess an industry useful level of understanding of the topic. Moreover, they cannot also be expected to perform effectively in the area unless extensive on-the-job training is undertaken in the industry.

There is a way however to salvage the situation given the correct set of circumstances. We suggest that "the project management subject should be employed as a focal point bringing together the material learned in previous subjects and using it to learn how to manage projects. We call this approach *the project management focus*. For this reason alone, project management should be taught in the final semester of the final year, so that the student and the instructor can draw relevant material from as many subjects as possible. Such an approach would lead, naturally, to a problem based learning (or action learning) instructional design; however, a discussion of this is outside the scope of this paper.

Although projects may have been managed for many millennia, it is generally considered that the scientific management of projects had its genesis in the 1960s Polaris submarine missile project. From this early Operational Research/Management Science (OR/MS) conception, project management mainly developed as an offspring of engineering and OR/MS. Over recent years, however, the concept of project management has evolved into an art and a science, has pervaded many human activities, and like *system* the word *project* has taken on social commonsense usage. (For example one now finds sections in text books attempting to semantically differentiate between social *programmes* and *projects*, organisations structured as *project based*, and debate in the literature on what constitutes a *project* and whether there is a difference between *project management* and *managing projects*.) The importance of successful IS project management and the resulting need for a wide range of skills is heightened by the challenges today's organisations face.

ORGANISATIONAL CHANGE, CHANGING APPLICATIONS AND EMERGING TECHNOLOGIES

The ability to change is vital for organisational survival. The increasingly wicked nature of the environment results in erratic and discontinuous change (Drucker 1969) forcing organisations to constantly adapt. Increasing competition, globalization and the demand for customer focus are some of the forces behind this need for change. In addition IT can act as driver, enabler or supporter of organisational change (McKeen, Smith 1996, Oden 1999) and has a profound effect on organisations (Lucas, Baroudi 1994). Much of the literature focuses on IT rather than IS and in today's organisations IT is perceived to be the base technology for IS. In an organisational context statements concerning the effect of IT are often also applicable to IS. The link between technology and organisational tasks and structure is well established (Leavitt 1964). Changes in organisation relevant technologies can bring about changes in the structure and function of organisations (Groth 1999). IS can blur organisational boundaries (Gerstein 1987, Oden 1999) and result in new organisational designs. Organisational change should therefore be considered as a component of effective systems development (McKeen, Smith 1995). The effectiveness of the project management process is critical for success (Gerstein 1987), since IS project failure can have serious consequences for organisational competitiveness and survival. Pressures on project managers to successfully "manage projects are therefore mounting.

IS development takes place in an organisational context and may therefore also be affected by events taking place in its environment and that may be beyond the control of project managers (Mumford, Macdonald 1989). Organisational change can for example, cause problems with participation in IS projects (Reponen 1998). As organisational boundaries become more fluid various groups of stakeholders may be involved in a project. Moreover the development of intra-organisational systems may include external as well as internal stakeholders whose requirements have to be considered. While on the one hand organisations form loose alliances supported by EDI and Internet technologies, others aim to achieve competitive advantage through consolidation. Researchers not only advocate that IS professionals and users should work closely together, but call also for the integration of IS development and HR (Tentenbaum 1999, Oden 1999).

Concepts developed as a way of helping organisations to cope with the challenge of change such as knowledge management also draw IS project teams, users and other organisational personnel closer together (Alavi, Leidner 1999). Researchers even suggest that in IT-enabled network organisations many functions traditionally carried out by IS/IT professionals will shift to users, who will take an active part in IS development (Mutsaers et al. 1998). As a result understanding of human behavior and learning capabilities is becoming more important for successful IS development. Increasingly the boundaries between IS and other organisational functions are disappearing. This indicates that the integration of project management with other subjects may be vital when preparing students for the "real world.

Gradually management's role is becoming one of coordination rather than directions and control (Brooke et al. 2000). There is a growing need for flexibility rather than controllability and predicability (Highsmith 1999). At the same time IS project management is moving towards collaborative management of geographically dispersed and fluid teams. Collaborative project management is culturally very different from traditional project management (Cutter 2000) and requires different approaches, people and skills. IS development teams may work and exist in a virtual environment, where teams need different communication techniques and the managers require different management skills (Watson, Sridhar 1998).

During the past decade the users and uses of IS have changed significantly (Friedman 1993). The focus has shifted from IS for organisational support activities such as transaction processing to applications for managers and professionals and groups rather than individuals. There has been a gradual shift in project management thinking over the past twenty years from a systems engineering /OR/MS focus to one where the focus of managing IS projects is more the ability to effectively manage complexity, uncertainty, and equivocality than IS/IT technical ability. For example, Applegate, McFarlan, McKenney (1997:624-639) suggest in some cases a non IS/IT professional should be selected as the project manager; and the traditional project planning and control tools [e.g., PERT, milestones, system specification standards, change control disciplines etc] are less important than contemporary management and organisational communication devices, personnel controls, and team integration procedures. A study by Lee by Lee, Trauth, and Farwell (1995) extends this view to the critical skills and knowledge requirements of IS professionals in general.

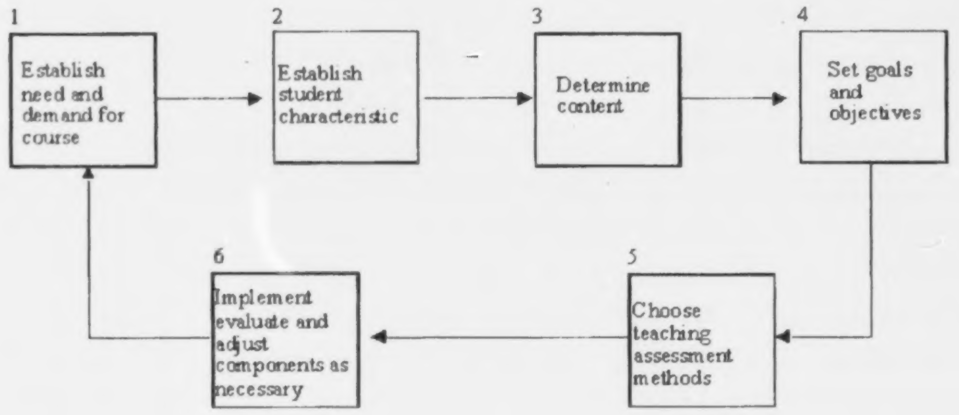
Technology is changing rapidly and new applications are emerging all the time. These changes should be reflected in training the IS graduate. This includes areas such as the competitive and strategic use of IS, project management, change management and collaborative work (Gorgone, Gray 1999). Emerging technologies very often not only replace old ones but also bring with them new methodologies of application that impact directly on firms at the procedural, policy and socio-technical interface. The external job market for IS graduates has changed drastically and it is therefore critical that university curricula are adapted to cater for these needs.

PROJECT MANAGEMENT

Despite the relatively long history of and the large amount of literature available on project management, on the subject of course content and how IS project management should be taught in higher educational institutions, the literature surveyed by the authors, is largely silent. Numerous articles by management, users, practitioners, and academics, however, suggest a need to re-think the field of IS/IT project management in order to learn from the successes and failures. Moreover, from a practitioner perspective, studies by Lundeberg (1993) show managers perceive IS projects to be always over budget and time; and to fail to deliver on expected benefits. Lundeberg comments that this may or may not be true, but it is management's perceptions and therefore it is something we need to address. The authors consider that this re-thinking should include institutes of higher education.

Stohr (1995) states the importance of developing, evaluating and re-developing curricula content to ensure that courses remain appropriate to the needs of students and employers in the rapidly changing IS/IT arena. However, following Toohey (1999) this is the third step in a typical course design model
(see Figure 1).

FIGURE 1
A TYPICAL MODEL OF THE COURSE DESIGN PROCESS – ADAPTED FROM TOOHEY (1999:21)


1
Establish need and demand for course
2
Establish student characteristic
3
Determine content
4
Set goals and objectives
5
Choose teaching assessment methods
6
Implement evaluate and adjust components as necessary

The needs and demand for a course in IS/IT project management is essentially acknowledged and indeed supported by professional associations such as the ACM, ACS, AIS, etc.. These bodies are often initiators of events that lead to eventual curriculum changes, and moreover provide knowledgeable input to curriculum design. For example, project management is a core requirement for gaining course accreditation with the Australian Computer Society (ACS). This is supported by the overview report of the first joint curriculum development effort for undergraduate programs in information systems (Couger et al. 1995) which includes the subject within the IS degree structure; and a study by Lee et al. (1995) which showed management skills (including managing projects) to be critical to the development needs of IS professionals.

In the absence of academic literature debate, the authors turned to the special issue on IS curricula and pedagogy (MIS Quarterly 19(3); in particular Couger et al. 1995) and to a survey of project management textbooks. On an undergraduate project management subject, Couger et al. (1995:351) state:

> **Scope:** This course covers the factors necessary for successful management of systems development or enhancement projects. Both technical and behavioral aspects of project management are discussed.
>
> **Topics:** Managing the systems life cycle: requirements determination, logical design, physical design, testing, implementation; system and database integration issues; metrics for project management and systems performance evaluation; managing expectations: superiors, users, team members, and others related to the project; determining skill requirements and staffing the project; cost-effectiveness analysis; reporting and presentation techniques; and effective management of both behavioral and technical aspects of the project.

Couger et al. (1995) do not develop this curriculum content further nor do they explain how this content can be shoe-horned into a single (or double) semester unit. They do, however, note the prerequisite need for IS students to have a "foundational knowledge in the disciplines within business administration ;and to have people skills, an understanding of organisations (functions and behaviours), and a basic understanding of mathematics, and the behavioural, social, and natural sciences (p.347). While this outline content, potentially, indicates a balance between the technical and people skills needs of a contemporary project manager the curriculum of the IS Major appears to be largely focussed on the technical skills, abilities, and knowledge required of an IS professional. (cf Applegate et al. 1997, Lientz, Rae 1999, D'Herbemont, César 1998, Shtub et al. 1994, Badiru, Pulat 1995). Indeed, the "Representative Abilities and Knowledge for IS Program Graduates presented by Couger et al. (1995:346) are firmly based in an epistemological and ontological world view of social objectivism that is: functionalist sociology (Burrell, Morgan 1980, Hirschheim et al. 1995). From an IS perspective, Hirschheim et al. (1995) and Lundeberg (1993) suggest this world view is reflected in the principal IS development methodologies and methods of the 1970s and 1980s. Such an approach may on longer be adequate in an era of persistent organisational change, sophisticated and influential users and new technologies.

THE NEED FOR INTEGRATION

One of the proposed traits in IS graduates put forward by the ACM/AIS on IS Graduate Curricula (Gorgone, Gray 1999) is the need for a strong integration of IT with business, a core knowledge of IS and most importantly, those specific skills leading to a career path. One of the sample career tracks put forward in the proposal is Project Management. The task force explicitly recognises that (Gorgone et al. 1998):

> ...project management is an important topic for the core at the M S level because it is a capability that an MS degree guarantees. ...Almost all IS development involve transforming an organisation from its existing ways of doing things. ....Students should understand and be able to implement the changes that an IS system creates.

An interesting and important recognition made by the ACM/AIS task force is in line with the proposal of the paper (arrived at independently in both cases) that is, integration in terms of the interrelation ship between courses. It therefore follows (from this generalisation), that project management as a discipline and career path would cuiminate in the final year with the integration all of those aspects that make Project Management a discipline. This aspect has been recognised by various organised professional bodies, so much so in fact that industry and now some universities (at the graduate level at least) are offering exclusive courses in the discipline. Further, the ACM/AIS task force argues that some aspects of Project Management and Change Management are dealt with in indirectly in other parts of the proposed curriculum. The authors argue that although this is an important recognition, the task force does not go far enough in identifying all of those elements that could be factual in the project management career track.

The recognition of curriculum integration is fundamental and has direct bearing on the student's capacity to recognise the connection between subject and their relevance to practicums, the fact that people do not use disciplines in isolation, it empowers critical thinking, it prevents curriculum fragmentation, prevents curriculum overload, it increases the ability to meet the student's learning needs, it recognises and minimises curriculum overlap, etc. (Jacobs 1998).

Although part of the knowledge needed to manage projects is restricted to "project management as seen in the traditional sense *id est*, critical path analysis, resource scheduling and so on, there is a great deal of overlap with other management disciplines such as business/corporate law, risk analysis, finance and accounting, planning at the strategic/tactical/strategic level, knowledge of organisational structures/behaviours, industrial relation issues, personnel relation issues, counselling, conflict resolution, etc.

As a basis for the argument of integration the project management framework proposed by PMI (the project management institute) provides a candid view of what professional associations see as the areas that influence/drive/support project management. The project management framework therefore is an ideal source of facts from which to begin an integrated project management curriculum design.

We note that within the PMI project management framework are the following (a more detailed listing is at Appendix 1):

1. **Project Integration Management**. Concerned with the coordination of the project elements. Of particular importance at this stage is the recognition that Project Integration Management is primarily integrative. It requires the documented development of a project plan, the project plan execution, and the development of control mechanisms to oversee and coordinate change across the project.

2. **Project Scope Management**. Defines the boundaries of the project in terms of the product produced and the work that must be done in order to deliver the product. It consists of the initiation phase followed by scope planning, scope definition, scope verification, and scope change control. Scope

planning requires knowledge and skills in product analysis, benefit/cost analysis, alternative identification, and expert judgement. Scope definition requires knowledge in the area of work breakdown structures in order to formulate adequate templates for the distribution of work into smaller and easier to manage blocks. Scope verification is the step where the project scope is presented to the client for acceptance. Scope change and control identifies and introduces those mechanisms which allow for the determination, introduction and management of beneficial changes.

3. **Project Time Management**. Includes those processes which are required to ensure the scheduled completion of the project. It requires identifying and defining each activity to be carried out for the completion of the project.

4. **Project Cost Management**. Requires those skills necessary to ensure that the project is completed within the allocated budget.

5. **Project Quality Management**. Required to ensure that the project will deliver a product within its defined scope. Key areas identified with quality management are quality planning, quality assurance, and quality control.

6. **Project Human Resource Management**. To make the most effective use of the human resource involved in the project.

7. **Project Communication Management**. Includes the processes required to, ultimately, disseminate the appropriate information in order to carry out and complete the project within schedule and budget. The required guidelines for proper communication management are communications planning, information distribution, performance reporting, administrative closure.

8. **Project Risk Management**. Is required to identify, analyse and respond to project risk. It is concerned with risk identification, risk quantification, risk response development, risk response control.

9. **Project Procurement Management**. It involves the acquisition of resources (goods and/or services) outside the organisation responsible for conducting the project. Areas of interest in procurement management are procurement planning, solicitation planning, solicitation, source selection, contract administration, contract completion.

Using the data at Appendix 1, the PMI project management framework can be represented diagrammatically as in Table 1. The Table shows the degree of overlap with other disciplines in a typical business faculty; and the degree of relative integration importance as indicated by the number of mentions given to activities in the PMI project management framework. Of note is the substantial overlap in areas of information systems, management, human resources management, industrial relation, accounting and finance, economics, industrial relations, and some marketing. We note the relative low integration mention of organisational development (change management and team work etc) and communication-oriented subjects; and we are in support of the (Australian) industry view that subjects lack quality in terms of imparting general critical thinking skills to the students. Here we refer to the recent Australian Federal Government survey of employers conducted by A C Neilson which found (in part) that university graduates needed to improve their independent and critical thinking, creativity, oral communication, and problem solving skills if they wanted to become more attractive in the job market. (http://www.abc.net.au/news/newslink/weekly/) (ABC) Project managers have traditionally focussed on cost, time, and quality. Ignoring for the most part people. We suggest that, indicatively, Table 1 implies a reinforcement of that approach. However, in the current (and future) organisational environment, we would

TABLE 1
DIAGRAMMATIC REPRESENTATION OF THE PMI PROJECT MANAGEMENT FRAMEWORK

Broad Activity	Relative Mentions	Providing Section
Organisational Policy	x	x xxMngt/Acct/Econ/Mkt
Corporate/contract law	x	x xIR
Marketing principles	x	x Mkt
QM/Systems Engineering/QFD	x	x xxxxxxMngt
TQM tools	x	x xxxxxMngt
Financial analysis/planning/control	x	x xxxxxxxxxAcct
Contingency planning	x	Mngt
Risk classification	x	Mngt
WBS	x	x xIS/IT
network modelling	x	IS/IT
estimating	x	x xxxxAcct/Econ
MS/OR	x	x xxxxxxxIS/IT/Math/Econ
Modelling/simulation	x	x xxxxxxxIS/IT/Math/Econ
Scheduling	x	Mngt/IS/IT
management and control systems	x	x xxxxMngt/IS/IT
PMIS	x	IS/IT
Information distribution/retrieval systems	x	x IS/IT
Benefit Analysis	x	x xxMngt/Acct/Econ
Performance measurement	x	x Mngt/Acct/IR/HRM
Stakeholder needs analysis	x	Mngt/Mkt/IS/IT
Management and Leadership theory/skills	x	x xxxMngt/HRM
Negotiation/communication theory/skills	x	x xMngt/HRM/IR
Organisation Development skills	x	x xMngt/HRM
Audits/reviews	x	x xxxxxAcct

Legend:
Acct: Accounting
Econ: Economics
HRM: Human Resource Management
IR: Industrial Relations
IS: Information Systems
IT: Information Technology
Math: Mathematics
Mkt: Marketing
Mngt: Management

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argue, general management competency and people skills (including change management, organisational development, communication, and negotiation skills are as important as cost, schedule, and quality possibly more so as they can bridge. the gap that often exists between these more traditional project management criteria. Successful project managers recognise the importance of people, after all how could we conduct a project without people. They also recognise that workers play an integral role in completing quality projects. Indeed, people are the initiators, developers, and deliverers of projects as well the users of projects products. We suggest that this view is supported by the findings of a joint academic and industry study into the critical skills and knowledge needs of IS professionals (Lee et al. 1995). That study found:

> ...technical specialist knowledge to be the least important for both now and in the future. At the same time, business functional knowledge and interpersonal/management skills were considered the most important in the future (p.327).

We support the findings of Lee et al. (1995) and intuitively note that these results appear to be in direct conflict with Table 1 and the AC Neilson survey results (reported earlier). Whatsoever, we caution that we have not located any body of research literature to support (or otherwise) our intuition. Consequently, we identify this as an area for our future research.

CONCLUSION

We have suggested that project management delivery can be enhanced considerably by using synergies that exist in a business-focussed environment. Specifically we drew attention to a growing wealth of pedagogical material which advocates integration as the means to produce a better focussed, critical thinker able to use a more holistic approach to problem solving. Further, we drew attention to material forwarded and supported by professional bodies, highly indicative of the same philosophy of thought in the areas of project management/project administration/change management. Finally, we have identified this as a potential area for future research.

REFERENCES

ABC. (2000). *Uni Graduates Urged to Fine Tune Critical Thinking*. Australian Broadcasting Commission. News Bulletin posted 07:11hours AEDT Wednesday, February 9, 2000. http://www.abc.net. au/news/newslink/weekly/. Accessed 7/2/2000.

ACS. (1998). *Guidelines for Accreditation of Courses in Universities at the Professional Level*. Australian Computer Society Inc.

Alavi, M. and Leidner, D. (1999). Proceedings of the 32nd Hawaii Internationa Conference on System Sciences.

Applegate, L.M., McFarlan, F.W., and McKenney, J.L. (1997). *Corporate Information Systems Management: Text and Cases*. Chicago: Irwin.

Badiru, A.B., and Pulat, P.S. (1995). *Comprehensive Project Management: Integrating Optimization Models, Management Principles, and Computers*. Englewood Cliffs: Prentice-Hall.

Brooke, C., Ramage, M., Bennett, K., and Gold N. (1998). "Change effects and legacy information systems: a framework to aid our understanding. *IFIP WG8.2 & WG8.6 Joint Working Conference on Information Systems: Current Isues and Future Changes*, Helsinki Finland December 10-13 1998. http://www.bi.no/dep2/ infomgt/wg82-86/proceedings/

Burrell, G., and Morgan, G. (1980). *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life*. London: Heinemann.

Couger, J.D., Davis, G.B., Dologite, D.G., Feinstein, D.L., Gorgone, J.T., Jenkins, A.M., Kasper, G.M., Little, J.C., Longenecker, H.E., and Valacich, J.S. (1995). "IS'95: Guideline for Undergraduate IS Curriculum. *MIS Quarterly*. 19(3). 341-369.

Cutter Consortium (2000). *E-Business Application Delivery*. XII(4) April 2000, http://www.cutter.com/ead/ead0004.html

D'Herbemont, O., and César, B. (1998). *Managing SensitiveProjects: A Lateral Approach*. Houndmills: Macmillan.

Drucker, P.F. 1969. *The Age Of Discontinuity: Guidelines To Our Changing Society*. London: Harper & Row.

Friedman, A. L. (1993). "The information technology field: a historicalanalysis ,in *Social Dimensions of Systems Engineering. People, processes, policies and software development*. Quintas, P. (ed). Ellis Horwood, pp. 18-33.

Gerstein M. (1987). *The Technology Conncection. Strategyand Change in the Information Age*. Addison-Wesley Publishing Company.

Gorgone, J. T., Gray, P. and Davis, G. B. (1998). The Information Systems MS Curriculum for the Twenty-First Century: Breadth, Depth, and Integration. (http://searchpdf.adobe.com/proxies/1/95/76/36.htm).

Gorgone, J. T. and Gray, P. (Ed.) (1999). MSIS 2000 Model Curriculum and Guidelines for Graduate Degree Programs in information Systems, ACM 1999

Groth L. (1999). *Future Organisational Design. The Scope for the IT-based Enterprise*. John Wiley & Sons.

Highsmith, J., (1999). "Adaptive Management: Patterns for the e-business era . *Cutter IT Journal*. 12(9), pp. 24-30.

Hirschheim, R., Klein, H.K., and Lyytinen, K. (1995). *Information Systems Development and Data Modelling: Conceptual and Philosophical Foundations*. Cambridge: Cambridge University Press.

Jacobs, H. H. (Ed.) (1989) Interdisciplinary Curriculum: Design and Implementation. Association for Supervision and Curriculum Development, Alexandria, Va. 1989.

Leavitt, H.J. (1964). "Applied organization change in industry: structural, technical and human approaches , in *New Perspectives in Organization Research*. Cooper, W. W., Leavitt, H. J., and Shelly M. W. (eds), John Wiley & Sons.

Lee, D.M.S., Trauth, E.M., and Farwell, D. (1995). "Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly*. 19(3). 313-340.

Lientz, B.P., and Rea, K.P. (1999). *Guide to Successful Project Management*. San Diego: Harcourt Brace.

Lucas, H. C. Jr, Baroudi, J. (1994). "The role of information technology in organisation design . *Journal of Management Information Systems*. 10(4), pp. 9-20.

Lundeberg, M.. (1993). "IS Methodology . in Glasson, B.C. (presents) State of the Art in Information Systems (Videorecording). Australia: Curtin University and the Australian Computer Society

McKeen, J. D., and Smith, H. A. (1996). *Management Challenges in IS: Successful Strategies and Appropriate Action*. John Wiley & Sons.

Meredith, J.R., and Mantel, S.J. (2000). *Project Management A Managerial Approach*. (fourth edition). New York: John Wiley.

Mumford, E., and Macdonald, B. (1989). *XSEL's Progress. The continuing journey of an expert system*. John Wiley & Sons.

Mutsaers E-J., van der Zee H., and Giertz H. (1998). "The evolution of information technology. *Information Management & Security*. 6(3), pp. 115-126.

Oden H. W. (1999). *Transforming the Organisation. A Social-Technical Approach.* Westport Conneticut; Quorum Books.

Reponen, T. (1998). "The role of learning in information systems planning and implementation . In *Information Technology and Organisational Transformation.* Galliers, R.D, and Bates, R.J. (eds). John Wiley & Sons, pp.133-149.

Shtub, A., Bard, J.F., and Globerson, S. (1994). *Project Management Engineering, Technology, and Implementation.* Englewood Cliffs: Prentice-Hall.

Stohr, E.A. (1995). "Introduction to special issue on IS curricula and pedagogy. *MIS Quarterly.* 19(3).

Tetenbaum, T. J. (1999). "Beating the Odds of Merger & Acquisition Failure: Seven key practices that improve the chance for expected integration and synergies . *Organisational Dynamics.* Autumn 1999, pp. 22-36.

Toohey, S. (1999). *Designing Courses for Higher Education.* Buckingham: Open University Press.

Watson M.B., Sridhar, F. (1998). "Communication and coordination in the virtual office . *Journal of Management Information Systems.* 14(4) pp. 7-28.

APPENDIX 1
BROAD PROJECT MANAGEMENT ACTIVITIES AND REQUIRED SKILLS

Broad Activity	Skills
Project Integration Management	Knowledge about work breakdown structures, cash flow forecasts, usage of estimating databases, organisational policies including quality management, personnel administration, and financial controls, linear algebra with constraints models is also applicable, Computer simulation, project management information systems, communications, leadership and negotiation theory, and finally games and decision theory to quantify unknowns.
Project Scope Management	Benefit measurement methods in terms of comparative approaches, scoring models, benefit contribution and economic models. Constrained optimisation methods such as mathematical models using linear, non-linear, integer algebraic methods. An appreciation, at lest, of Marketing principles such as market share and public perceptions. System engineering, value engineering, value analysis, function analysis, quality function deployment, estimating tangible and intangible costs and the various benefits from project alternatives, and financial measures such as ROI or payback period are needed to assess the viability of the identified alternatives. Works breakdown structure templates project decomposition to the point where adequate costs and duration estimates can be achieved. Inspection in the form of reviews , audits and structured-walkthroughs are a requirement of this stage. Management approval structures, tracking systems and integration with the overall change control system. Performance measurement techniques are also employed.
Project Time Management	Interactivity dependencies and their orderly sequence. Estimating the duration of each of the activities against a time scale. Creating a project schedule. And finally setting up a control mechanism to apply any changes.
Project Cost Management	Involves aspects of resource planning, cost estimating, cost budgeting, and cost control. Work breakdown structures, resource planning, organisational policies, estimation techniques such as analogous estimating, parametric modelling, bottom-up estimating, computer aided estimates, tracking and auditing systems, earned value analysis, tracking systems, earned value analysis.
Project Quality Management	Benefit/cost analysis, bench marking, flowcharting techniques, simulation, quality audits, control charts, pareto diagrams, statistical sampling. [familiarity with quality standards?]

Project Human Resource Management	Organisational planning staff acquisition, team development. Knowledge for carrying out human resource management needs to be acquired from negotiation skills, team-building activities, general management, reward and recognition systems.
Project Communications Management	Stakeholder information need analysis, communication skills, information retrieval systems, information distribution systems, performance reviews, variance analysis, trend analysis, earned value analysis.
Project Risk Management	Flowcharting, risk classification schemes, interviewing, expected monetary value, simulation, statistics, decision trees, expert systems, contingency planning, corporate law.
Project Procurement Management	Make or buy analysis, expert systems, contract law, contract negotiation, marketing, estimating, tracking systems, accounting, procurement audits.

PROGRAM ASSESSMENT IN AN UNDERGRADUATE INFORMATION SYSTEMS PROGRAM: PROSPECTS FOR CURRICULAR AND PROGRAMMATIC ENHANCEMENT

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ABSTRACT

This paper examines the assessment of an undergraduate program in Information Systems. It presents an approach to program assessment that has proven beneficial to one institution. The data from program assessment can be useful to stakeholders and forms a baseline for program improvement.

INTRODUCTION

A major trend in U.S. higher education of the last ten years has been towards educational assessment. Universities, accrediting organizations, professional academic associations, and government review panels have requested and often demanded assessment information from schools, departments, programs, projects, and individual faculty. One example is the AACSB accreditation standards for business schools, which require for accreditation that a variety of assessment processes be in place. In the field of information systems, not much has been reported in the literature on program assessment, yet it is important because IS programs are growing in size and their success needs to be monitored and informed steps taken to improve the curricula.

This paper offers an assessment model approach for program assessment of IS undergraduate programs. It presents the case example of results of program assessment for the B.S. in Information Systems at University of Redlands (UR). It demonstrates the usefulness of the approach to understanding the overall success of an IS degree program as well as details of program elements. The example points to many ways that the outcomes of assessment can be utilized for IS program improvement.

The B.S. in IS at UR is a 14 year old program that had undergone three major curricula upgrades, with a fourth one planned in the fall of 2000. The prior curricula changes were effected in the years 1986, 1992, and 1997. The curricula were based on national model curricula, including the DPMA 90 curriculum, and the IS 97 curriculum (it was available in preliminary form two years prior to its final release in 1997.) The Redlands B.S. in IS is a degree completion program that includes only junior and senior undergraduate years, with the first two years of work done at another university or college. The Redlands 97 curriculum's knowledge attainment goals are shown in Table 1. The Redlands 97 IS curriculum consists of the IS major consisting of nine IS courses, as well as one humanities course, one upper division mathematics course, and four business courses (See Table 2). The nine IS courses encompass nearly all of the IS '97 model curriculum, with the exception of several introductory courses. However, since the students enter as working adults, many with IS industry experience and jobs, a more condensed curricular introduction was felt to be appropriate. The IS major is distinguished by two required courses that are not standard in IS '97: a course in geographic information systems (GIS) and a course in computer ethics. Both of these courses relate to strengths of the university: it is known for its strong GIS faculty and it has a liberal arts foundation that ethics relates to.

TABLE 1
KNOWLEDGE ATTAINMENT GOALS OF BSIS MAJOR PROGRAM

- Understand an apply structured programming techniques
- Be conversant in fundamental C language capabilities
- Understand the Graphical User Interface (GUI) principles
- Be conversant in fundamental Visual Basic language capabilities
- Understand the basic terms and components of the relational database model
- Understand and be able to apply database application development using Access in conjunction with the VisualBasic programming language
- Understand and apply the fundamental concepts and terminology associated with networking and telecommunications
- Understand and be able to build internet and web-based applications
- To appreciate the design and structure of geographic information systems as a decision_making tool
- To demonstrate knowledge of decision support systems, executive information systems, and expert systems including some hands-on applications
- To understand how the decision making process can be enhanced by modeling
- To appreciate the practical benefits of management support systems in real business settings and in society
- To obtain skills in spatial analysis
- To become knowledgeable of the ArcView GIS software applications. Be able to implement hands-on basic GIS functions using ArcView
- To appreciate how decision_makers in the public and private sectors can better assess and make

decisions on managerial problems through the use of GIS

- Understand the concepts and principles of structured and object oriented methodologies in systems development
- Be able to apply effective system modeling tools and skills including CASE
- Understand the perspective of complete life cycle activities, their value and application
- Understand information systems from the perspective of pieces of an organizational system
- Understand the magnitude of technological advances and their implications to ethical issues
- Understand the theoretical perspective of ethical philosophies as they relate to business and organizations
- Identify and understand examples of real world ethical dilemmas in information systems including the many sides of such dilemmas
- Be able to discuss and properly communicate the basic concepts of information systems
- Be able to design and build a business information system
- Be able to develop and implement software in a business project solution
- Communicate a complete systems project including verbally presenting and writing up and documenting the project

TABLE 2
CURRICULUM OF BACHELOR OF SCIENCE IN INFORMATION SYSTEMS (BSIS)

ISYS 312	Productivity with Information Technology
MGMT 310	Philosophical Foundations of Management
ISYS 219	Fundamentals of Structured Programming with C
MGMT 330	Managing and Leading Organizations
ISYS 317	Introduction to Programming Techniques: Object-Oriented Programming
MTHW 303	Mathematical Applications for Information Systems
BUAD 337	Political and Business Economics
ISYS 318	Database Concepts
BUAD 469	Accounting Information Systems
ISYS 425	Management and Decision Systems
ISYS 365	Geographic Information Systems:
BUAD 340	Principles of Marketing
ISYS 489	Applied Software Development Project II
ISYS 415	Computer Ethics
ISYS 404	Systems Analysis and Design
ISYS 488	Applied Software Development Project I

After the Redlands IS 97 curriculum had been run for two years, the IS faculty initiated a plan of program assessment that was carried out in early 2000. The assessment model consists of the following steps: (1) written survey of the 300 current students of the extent that their knowledge or competency of the program objectives and on their suggestions for program enhancements, (2) written survey of 700 alumni of the program on the extent that program objectives have helped them in their careers and on their suggestions for program enhancements, (3) focus group with the IS Degree Program Corporate Advisory Committee on their recommendations for curricular improvement, (4) focus groups with samples of current students about their suggestions for curricular improvements, and (5) IS faculty review and suggestions of current curriculum.

The approach is multi-faceted, i.e., it includes many stakeholders and several methodologies. In particular, it gathers data from current students, alumni, corporate advisors, and IS faculty. It utilizes the methods of written survey, directed focus groups, and discussion. All of this information is aggregated together to form part of the IS program assessment report. Other information required by the university is added to the report including for instance data on the program, current status of the curricular and support services, advising, and math and writing skills. Altogether, this larger amount of data than is ordinarily collected provides a more in-depth insight into the program successes and failures, strengths and weaknesses, and feeds information into design of the future curriculum.

Results of Assessment Procedures

Program. The BSIS program was assessed through three open-ended questions in two surveys, one of current students and a second of alumni. A third program assessment was conducted through two focus groups with BSIS students. In the hour and a half focus group sessions, the students were first presented with the results of the BSIS curricular survey. Then there was a segment of discussion of the curricular results. Finally, there was a 45 minute open group discussion of suggestions for the BSIS program and curriculum.

Only the survey responses responses from current BSIS students that made specific recommendations are included, i.e., a comment such as "great program" is not included because it does not inform the assessment process. Question 3 pertains especially to the program. There are several general points coming out of these comments regarding the program. On is that student would like to see the latest technology emphasized in the program. This implies that in program revision, attention needs to be given to the most current and important technical skills. Responses also support review for very recent and current textbooks underpinning the technical skills. There are several comments about workshop/tutorial preparation in math and writing skills as important. In general the administrative mechanics and support services of the program are not commented on, which would imply that they are working well.

The summary of the two BSIS student focus groups underscore several points regarding the program. One is that the pre-entry counseling and advertising materials need to correctly position the program balance. In particular, the BSIS program offers a balanced blend of managerial and technical content. However, some incoming students have mis-read the program as strictly technical. Students are not clear on the level of technical expertise that they will be expected to achieve i.e., will they be intermediate programmers or master programmers? The program needs to articulate its goals early on. One comment in response is that the survey numerical responses indicate a considerable range of incoming technical knowledge/competency in particular between 1 and 3.5 on a 1 to 5 Likert scale. Hence, part of the misunderstanding is that students technical mastery levels will remain different throughout the program and what can be standardized is the minimum level of technical knowledge/competency.

Overall, the student suggstions/recommendations are centered on the technical content of the program; they are seeking expanded technical coverage. They appear satisfied with the program administration and academic support and service elements.

Curriculum. The survey of current students measured Likert scale responses on the extent of current knowledge of 26 program objectives. For N=53 responses, the average current knowledge was 2.59 on a 1 to 5 Likert scale, with 5 being the highest value. This reflects an intermediate state of current knowledge, which is to be expected for the full spectrum of students over the two years of the program. The comparison of students in the first half of the program i.e., junior year to those in the second half i.e., senior year shows an average current knowledge of juniors of 2.45 and of seniors of 2.73, for an average gain of 0.28, or eleven percent. When juniors are compared with students who were seniors in the last six months or had just completed the program, the average gain in current knowledge was 0.57 or twenty three percent. These results provide confirmation of the learning value of the IS major. We interpret that the gains are not even higher because the student population consists of working adults students, most of whom come into the program as IS or technology professionals, so their starting knowledge base is higher than for traditional younger resident students.

The gains in current knowledge from the program can be further disaggregated by the sixteen program objectives. Comparing juniors to seniors in the last nine months and a few very recent graduates, the following are the ranked gains by program objective.

	Current BSIS Students	
Rank	***BSIS Program Objective***	***Av. Gain in Current Knowledge from Jr. Year to Last 9 Mos.***
1	Access in Development	1.06
2	Dec. Making with GIS	1.05
3	Communicate Project	1.03
4	Database Applications	0.98
5	Relational Database	0.94
6	Methods of Syst Analysis	0.94
7	CASE & Syst Tools	0.92
8	Visual Basic	0.79
9	Structured Programming	0.78
10	Syst Life Cycle	0.63
11	ArcView Software	0.57
12	Internet & Web Applications	0.56

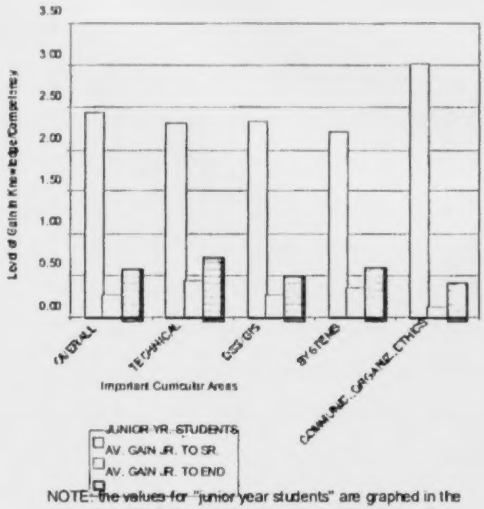
13	GUI Interface	0.54
14	Communic. Basic Concepts	0.53
15	C Language	0.47
16	DSS/EIS	0.46
17	Decision Making	0.45
18	Design/Build an IS	0.43
19	Spatial Analysis	0.36
20	IS Project Solution	0.35
21	Ethical Dilemmas	0.33
22	Organiz. Systems	0.31
23	Ethical Philosophies	0.13
24	Ethic Implic of Techn.	0.13
25	Mgt Support Systems	0.10
26	Networking Concepts	0.04

The information in the disaggregated table is valuable in determining where the most learning is taking place and where learning is not as effective, so future improvements can be focused in those areas. The results confirm extensive learning in GIS decision making, a new area for most students, in communication of project, and in the mainstay areas of data-bases and systems development. Also, CASE tools and visual basic are high. Those are areas in the present curriculum that appear to be working well and are likely to be retained in the new BSIS 2000 curriculum although modernized.

On the other hand, areas that are not doing well as measured by the extent of knowledge gain are networking concepts, management support systems, certain aspects of computer ethics, organizational systems, and solutions with IS projects. These are pointing to areas in the BSIS 2000 curriculum in which to redesign courses and educational strategies and to seek major teaching and learning improvements. For instance, the low score for networking concepts may stem from the lack, until recently, of a hands-on networking laboratories for training on NT administration and configuration. Small practice networks have now been located in the Jones Center and all the major regional centers. Also, the networking course was in need of revision, a task which has recently been accomplished, but may need even more revision and attention in the new curriculum.

There are a number of gender differences in knowledge/competency by program objectives. The statistically significant gender differences for competency/knowledge of current students are for: structured programming and C language ($p=0.05$) and there are lesser differences for networking and ethical dilemmas ($p=0.10$). In all these cases, the knowledge competency of males exceeds that of females. The programming and networking differences may relate to occupational differences prior to entry, while the difference in knowledge of ethical dilemmas may related to differential prior exposure to ethical dilemmas in the real world.

The knowledge/competency results can be grouped by major curricular areas. For instance, the Systems curricular area comprises the knowledge/competency objectives of methods of systems analysis, CASE and systems tools, systems life cycle, designing/building an information system, and IS project solution. When the knowledge/competency of current BSIS students is grouped by major curricular areas (see Figure 1), the highest levels of knowledge/competency are in communications/organization/ethics, while the lowest levels are in DDS/GIS and systems, with technical in the middle. This emphasizes that the students have



NOTE: the values for "junior year students" are graphed in the range from 0 to 5, but actually are in the range from 1 to 5.

considerable knowledge of the softer sides of the curriculum. Figure 1 also demonstrates a gender gap overall and for the four major knowledge/competency areas. This mostly relate to the prior levels of experience an entered the BSIS have had more expe

To a less differences in self Since the gende difference bears regards the reason

The gain in kr curricular areas (Fi is highest in t lowest in the organizations, and learning gain of 23 curriculum occurs student entry know curriculum is pro moderate to weak areas initially. On the other hand, the least learning gain occurs in communications/organization/ethics. This is the area of strongest initial knowledge. This may be explained by motivational factors i.e., that students are more motivated to learn about the technical and systems areas due for job and career related reasons.

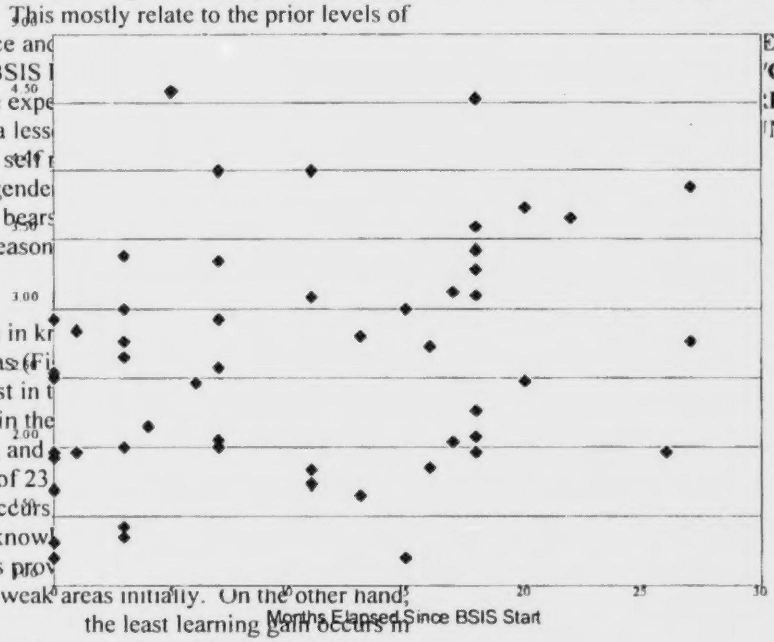


FIGURE 2
OVERALL KNOWLEDGE/COMPETENCY VS. TIME IN PROGRAM, CURRENT BSIS STUDENTS

E 1
'COMPETENCY OF
:RICULAR AREAS,
'MNI

Correlation analysis for the aggregated knowledge/ competency areas and with elapsed program duration in months shows signficant correlations among the overall knowledge competency and the four important areas (see Tables 3 and 4). This implies that generally a student is higher or lower in knowledge competency in all the areas i.e., they vary up and down together among individuals. This points to a more generic set of knowledge/competency across areas. This may reflect the real world experience of adult students. For instance, a student who had worked in a systems analysis position for ten years before entering the BSIS would have built up knowledge in all of the four major areas, while an entering student without any IS job experience would be weak in the technical, systems, and DSS/GIS areas. It is somewhat less clear why he/she would be weak in communications/organizations/ethics as well, but that is the case.

The correlations also show the correlation with elapsed time in the program. There is a statistically significant correlations of overall and technical knowledge/ competency with elapsed time, but not with the other areas. This is seen in the scatter plot shown in Figure 2. What is clear in all these areas is that there is a large range of incoming competencies; again this relates to the population of adult students. For overall knowledge (Fig. 1) and technical knowledge, there is a significant trend of increase over the two years. Yet, at graduation, there is still substantial range of knowledge/competency. The trend line has moved up, but the high variation remains. This is helpful in explaining teaching challenges even late in the BSIS program of a large range of competencies in a single cluster group. We interpret this as continuation of incoming ranges. By contrast, for communications/organizations/ethics, the average incoming knowledge/competency is higher but with an even larger range and doesn't increase much with the same large range throughout the program.

The data from the alumni survey were equally revealing. The key question related to program objectives is different; it asked how well the IS degree had impacted the alumni's career advancement. The following were the ranked program objectives (on a 1 to 5 Likert scale, with 5 being the highest impact):

The alumni results point to the importance of the "softer" sides of the curriculum on career impact — areas such as communications, organizations, designing and building an IS project, and the "building block" areas of systems development and database. The top two objectives are the area of interpersonal communications. This result corresponds to other studies in the IS educational literature that stress the IS career advances of interpersonal skills and teamwork (see literature review in Pick and Schenk, 1993). In general, this literature points to the "softer" areas as ultimately having more impact on IS graduates careers in the long term. It is important to ask why these behavioral skills rise to such importance. One reason may be the rising career attainment of BSIS alumni, so that eleven percent of the alumni are in top management (President, VPs) and forty percent are in middle management or higher. In middle to top management jobs, the areas of communications, teamwork, and organizations are essential.

TABLE 3
CORRELATIONS OF IMPORTANT KNOWLEDGE/COMPETENCY AREAS FOR CURRENT BSIS

	Months	Overall	Technical	DSS/GIS	Systems	C/O/E
Months	1					
Overall	0.309*	1				
Technical	0.349**	0.923**	1			
DSS/GIS	0.273	0.863**	0709**	1		
Systems	0.251	0.923**	0.798**	0.732**	1	
C/O/E	0.186	0.891*	0.682**	0.771**	0.852**	1

* significant at 0.05 level
** significant at 0.01 level

TABLE 4
CORRELATIONS OF CAREER IMPACT ON ALUMNI FOR IMPORTANT BSIS CURRICULAR AREAS

	Year Graduated	Overall	Technical	DSS/GIS	Systems	C/O/E
Year Graduated	1					
Overall	-0.187	1				
Technical	-0.047	0.818**	1			
DSS/GIS	-0.287*	0.754**	0.436**	1		
Systems	-0.235	0.817**	0.579**	0.5[illegible]	1	
C/O/E	-0.202	0.746**	0.351**	0.560**	0.623**	1

* significant at 0.05 level
** significant at 0.01 level

	Alumni	
Rank	***BSIS Program Objective***	***Impact of BSIS Program Objective on Alumni's Career Advancement***

1	Communicate Project	4.08
2	Communic. Basic Concepts	4.04
3	Syst Life Cycle	4.00
4	Organiz. Systems	3.98
5	IS Project Solution	3.97

6	Design/Build an IS	3.92
7	Relational Database	3.84
8	Database Applications	3.79
9	Ethical Dilemmas	3.75
10	Ethic Implic of Techn.	3.73
11	Ethical Philosophies	3.69
12	Access in Development	3.63
13	Networking Concepts	3.53
14	Mgt Support Systems	3.50
15	Methods of Syst Analysis	3.36
16	Decision Making	3.31
17	Dec. Making with GIS	3.23
18	CASE & Syst Tools	3.22
19	GUI Interface	3.13
20	Visual Basic	3.12
21	Spatial Analysis	3.03
22	DSS/EIS	3.01
23	Structured Programming	2.98
24	Internet & Web Applications	2.88
25	ArcView Software	2.13
26	C Language	1.95

Systems life cycle is in third place, fifth, and sixth place interspersed between interpersonal communication and organizational knowledge. Database design and concepts are sixth and seventh. From the standpoint of curricular revision, this points to the need to put even greater emphasis on these behavioral, organizational, and ethical areas. These are long time mainstays of the systems field and model curricula. Systems develop-ment has proven to be a robust knowledge area over a number of iterations of national model curricula (DPMA, 1990, 1997). It is likely that systems development will be retained in the BSIS 2000 curriculum, although it will take a different form i.e., it will likely be more oriented towards rapid development in the context of the web and dynamically changing environments.

Database is the most valued technical curricular area for alumni career advancement. This again reflects an enduring mainstay feature of national model curricula. Databases have persisted in importance in IS. They remain so in the internet age, since database underlies many aspects of e-commerce and e-business.

Alumni rate the career impact of ethics in the upper moderate range. It may be that BSIS graduates, with rising career attainment and often managerial or high level systems status, run into ethical issues to an increasing extent.

At the lower end of perceived career benefits are a number of technical areas including C language, ArcView software, internet and web applications, and structured programming. By contrast, those technical areas were all in the middle range for current student's curricular knowledge gain. There are several explanations. First, some of these areas are so new (ArcView, internet) that most of the graduates could not have been exposed to them in the BSIS or outside of the university at the time of their BSIS schooling. The C language and structured programming may be less important because of the occupational rise of alumni towards management and senior systems positions that involve less hands-on programming. This is reflected in the respondent profiles which show that only eight percent of alumni are in programmer positions. At the same time, only two percent of the sample of current students are programmers.

The lower perceived career value of technical curricular objectives underscores the fast movement of technology, so future BSIS alumni may not be able to utilize the technical skills they are learning today on a career basis. This is contrary to the sometimes strongly stated desire of current students to master technical skills.

Generally, the alumni findings on specific curricular areas point to the importance of the "softer" behavioral elements in the curriculum as well as the long-time mainstays of systems development and database.

The results by gender indicate that alumni male BSIS students have greater career impact of the program. The only statistically significant difference is for the career impact of communicating the project, with males having higher impact. This is unexplained.

The results of the first open-ended question for current BSIS students provide valuable additional suggestions/comments on the curriculum. In particular, question 1 concerns improvements in the BSIS curriculum. The suggestions focus on (1) expanding and improving the technical content, (2) adding optional workshops, tutorials, and elective courses that might even include certificate training, such as Microsoft SCCE. In the technical realm, students are particularly interested in expanding the Visual Basic coverage, perhaps by adding another course.

The results of the second open-ended question concern the value of the non-major courses in the BSIS program. There seems to be diverse opinions about Mgmt. 310 (Philosophical Foundations of Management) ranging from strong support to dislike/request to eliminate it. Looking at the parts of Mgmt 310, the humanities segment seemed more supported than the portfolio part. There was also a suggestion to separate the course into two courses and move the portfolio part later in the curriculum. The student response on the Mthw 303 (Mathematical Applications for Information Systems) course was mixed. We can assume that this may depend on the extent of individual student preparation and particular instructors. Reflecting other responses, some students may need tutorials and workshops to enhance readiness to take Mthw 303. The responses on the Mgmt. 330, Buad 337, and Buad 469 courses were generally good.

Another aspect of the assessment of student work in the BSIS Program is the student experience with senior project. An evaluation was conduced by Jeff Kim of a random sample consisting of BSIS senior projects, with 3 project reports in 1998; 3 in 1999; and 4 projects from 2000. The findings indicated the following accomplishments in the senior project: (1) high level of systems implementation. (2) documentation report was visible, and (3) students followed the project report structure offered by the project guidelines. However, the evaluation pointed to the following areas of weakness or challenge. No analysis was done on the real world organizational context of the projects. This is important for several reasons. Studies are increasingly pointing to the organizational aspect as important to systems success. Second, the organizational context touches based as a capstone element with the organizational/ managerial side of the BSIS curriculum. The BSIS 3 year goals in section 9 point to this area. Secon, no analysis was done in the sample projects on workflow, except in the case of "Use Case" analysis. Again, this is an important concept today for the practical success of systems, and needs to be emphasized in project enhancements in the future. Third, each stage of the project design and implementation appeared to be disjointed. In other words, the project calendar of "piece work" assignments that are put together at the end may be discouraging an integrated series of project tasks that are coordinated together. This can be improved by modifying the BSIS project guide to stress returning sometimes to earlier concepts and prior activities and steps, and to generally being more holistic. Lastly, the project reports did not reflect enough of what the students had learned from the exercise of doing a project, with the exception of one report written in 2000. This is a part of "reflection," which correlates with missions and would add to the learning and experience of projects.

The goals and objectives later point to areas for improvement of the senior project. The project assessment also points to the need to assess the timing and sequence of the project and project related (e.g. ISYS 404) courses; this can be considered with the present curriculum, prior to the BSIS 2000 implementation. A final point is that the focus of knowledge and learning may need to be refocused. We need to think through the goal overall of the project. Is it to perform systems analysis, write up requirements, program, and evaluate the outcome? Is it keyed to preparation for jobs and hiring on graduation? Or is it to reflect on the principles of systems design? These need to be thought through more and articulated to students better, as well as practiced in the way decided upon.

As an example of the assessment findings, the survey of current students received Likert scale responses on the extent of current knowledge of 26 program objectives. For N=53 responses, the average current knowledge was 2.66 on a 1 to 5 Likert scale, with 5 being the highest value. This reflects an intermediate state of current knowledge, which is to be expected for an even distribution of students over the two years of the program. The comparison of students in the first half of the program i.e., junior year to those in the second half i.e., senior year shows an average current knowledge of juniors of 2.55 and of seniors of 2.79, for an average gain of 0.25, or about ten percent. When juniors are compared with students who were seniors in the last six months or had just completed the program, the average gain in current knowledge was 0.42 or about sixteen percent. These results provide confirmation of the learning value of the IS major. We interpret that the gains are not higher because the student population consists of working adults students, most of whom come into the program as IS or technology professionals, so their starting knowledge base is higher than for a traditional younger resident student.

The gains in current knowledge from the program can be further desegregated by the sixteen program objectives. Comparing juniors to seniors in the last six months or recent graduates, the following are the highest gains by program objective.

Doing the same comparison, the areas of lowest gains (or losses) were the following.

The information in the disaggregated table is invaluable in determining where the most learning is taking place and where learning is not as effective, so future improvements can be focused in those areas. For instance, the results confirm extensive learning in GIS, a new technology area for most students, in verbal communications, and in the mainstay areas of data-bases and systems development. Those are areas in the present curriculum that appear to be working well and will likely be retained in the new curriculum although modernized.

On the other hand, areas that are not doing well as measured by where learning is taking place are the world wide web, networks, organizational systems, certain aspects of computer ethics, and DSS/EIS. These are pointing to areas in the new curriculum to seek major teaching and learning improvements. For instance, the university has been behind schedule on implementing its high speed campus network, which until recently has reduced the potential for learning of world wide web skills. Given the importance of this area in industry, it is something that is urgently pointed to for the new curriculum. The low score for networking may stem from the lack, until recently, of a hands-on networking laboratory for training on NT administration and configuration. Also, the networking course was in need of revision, a task which has recently been accomplished, but may need even more revision and attention in the new curriculum.

Rank	Program Objective	Average gain in current knowledge from junior year to last 6 mos of curriculum plus recent grads
1	GIS	1.36
2	Communication of a major project	1.12
3	Relational Data-base	1.12
4	Systems Dev. Life Cycle	0.95
5	CASE tools	0.94
6	Data-base Applications	0.92
7	Verbal Communications	0.58

Rank	Program Objective	Average gain in current knowledge from junior year to last 6 mos of curriculum plus recent grads
21	Dec Supp Systems/ Exec Inf. Systems	0.13
22	Understanding the Implications of technology advances for ethical issues	0.12
23	Understanding the theoretical perspective of ethical philosophies as they relate to businesses and organizations	0.10
24	Organizational Systems	-0.12
25	Networks	-0.24
26	World Wide Web	-0.62

The data from the alumni survey were equally revealing. For instance, on the question of how well the IS degree had impacted the alumni's career advancement, the following were the ten highest program objectives (on a 1 to 5 Likert scale, with 5 being the highest impact).

Rank	Program Objective	Rating of Impact of Program Objective on Alumni's Career Advancement
1	Verbal Communications	4.04

2	Communication of a Major Project	4.04
3	Organizational Systems	3.96
4	Systems of Life Cycle	3.96
5	Senior Project	3.93
6	Relational Data-Base	3.89
7	Be Able to Design and Build a Business Information System	3.88
8	Data-Base Applications	3.84
9	Understanding the Implications of Technology Advances for Ethical Issues	3.72
10	Understanding Ethical Delemmas	3.72

The alumni results point to the importance of the softer sides of the curriculum on career impact — areas such as communications, organizations, conducting a project, and ethical issues. Systems life cycle is in between in "softness" and is ranked a high fourth. The more technical areas of data-base are present but ranked sixth and eighth. This confirms some other literature that have pointed to the "softer" areas as ultimately having more impact on IS graduates careers. From the standpoint of curricular revision, this points to the need to put even greater emphasis on these behavioral, organizational, and ethical areas.

The results from the focus group sessions with students and the discussions with the corporate advisory committee were equally informative, but are not covered in this extended abstract, but will be in the full paper. Suffice it to say that they delved into certain issues in even more depth and provide even greater knowledge of current status of curriculum and the recommendations for the new one.

In summary, this paper presents a new model for IS program assessment, with an emphasis on curriculum. Many stakeholders can be involved in a more extensive data-gathering process that provides more robust information on student learning, alumni career benefits from their education, and corporate advice for program and curricular improvement and change. The assessment process serves to set a baseline than can be re-tested longitudinally over time to benchmark longer term program advances. The methods can be adapted for a wide variety of IS undergraduate and graduate programs. In another paper we suggest more detailed steps that programs can take to instill a full program and curricular assessment process into their strategic planning and development.

REFERENCES

BSIS. (1997). "Student Project Guide: Applied Software Development Project ISYS 488/489." Redlands, California: Programs in Information Systems.

Blum, E. (1998). "Student Survey Results." Redlands, California: Whitehead College, University of Redlands.

Blum, E. (1999). "Student Survey Results 1999." Redlands, California: Whitehead College, University of Redlands.

Depresses, B. and Fagan, K. (1998.) "Regents College Outcomes Assessment Framework: A Model for the Assessment of General Education Outcomes for the Adult Distance Learner," In *Distance and Diversity: Adult Learners in the Next Millennium Proceedings*, San Diego, California, 18th Annual Alliance/ACE Conference, pp. 40-46.

Dept. Mgt. and Business. (1999). "Full Time Faculty Staffing Plan, Department of Management and Business." Redlands, California: Department of Management and Business, University of Redlands. February 9. 9 pages.

Dept. Mgt. and Business. (2000). "Management and Business Self-Evaluation Version 1.0." Redlands, California: Department of Management and Business, University of Redlands.

Gibbons, R. (2000). "Instructional Support and Technology Assessment of the Adjunct Faculty for the University of Redlands." MBA in Information Systems Project Practicum. Redlands, California: University of Redlands.

Guthrie, Ruth, Schaeffer, D.M. and Pick, J.B. (1996). "The University of Redlands Honors Distinction for Bachelor of Science in Information Systems."_*ISECON '96*. Park Ridge, Illinois, Data Processing Management Association Education Foundation.

DPMA. (1992). *DPMA National Model Curriculum in Information Systems*. Park Ridge, Illinois: Data Processing Management Association.

DPMA Task Force. (1997). *IS '97 National Model Curriculum in Information Systems*. Park Ridge, Illinois: Data Processing Management Association.
Hartman, D. E. and Schmidt, S.L. (1995). "Understanding Student/Alumni Satisfaction from a Consumer's Perspective: the Effects of Institutional Performance and Program Outcomes. *Research in Higher Education* 36(2):197-217.

Hutchings, P. and Marchese, T. (1990). "Watching Assessment: Questions, Stories, Prospects." *Change*. September/October, pp. 13-38.

Maehl, W.. (2000). "Collaborating with Corporate Clients to Create New Programs: Bachelor of Science in Information Systems, University of Redlands," Section in *Lifelong Learning at Its Best*. San Francisco: Jossey-Bass, 225-231.

Peinovich, P. E., Nesler, M.S., and Thomas, T.S. (1997). "A Model for Developing an Outcomes Assessment Plan: The Regents College Outcomes Assessment Framework," in Amy D. Rose (ed.), *Assessing Adult Learning in Diverse Settings*, San Francisco, Jossey-Bass, pp. 55-63.

Pick, J. B. and Schenk, K.D. (1993). "Development of An Information Systems Curriculum Non-traditional Students." *ISECON '93. Proceedings of the Tenth Information Systems Education Conference*. Park Ridge, Illinois: Data Processing Management Association Education Foundation, pp. 148-155.

Pick, J. B. and Schenk, K.D. (1996). "Curricula for Information Systems Undergraduate Education for the Future." *Proceedings of Americas Conference on Information Systems*. Phoenix, Arizona: Association for Information Systems.

Reisberg, L. (1999). "Colleges Struggle to Keep Would-Be Dropouts Enrolled." *The Chronicle of Higher Education*. October 8, p. A54-56.

Schenk, K.D. and Pick, J.B. (1998). "Successful Strategies for Corporate Involvement in Information Systems Programs." *Journal of Computer Information Systems*.

Siwolop, S. (2000). "Breaking Out of the Back Room: Chief Informationi Officers Get New Respect and Power." *New York Times*. May 16, page C1-C6.

Whitehead College Admissions. (2000). "BSIS Assess of Planned versus Executed Cluster Starts." One page. February 4.

IMPROVING TEACHING EFFECTIVENESS UNDERSTANDING AND LEVERAGING PRIOR KNOWLEDGE FOR STUDENT LEARNING

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ABSTRACT

The prior knowledge that a student brings into the lecture is one of the major factors influencing teaching effectiveness. It is therefore important that lecturers are able to ascertain the level of prior knowledge and adjust their teaching accordingly. This paper adopts an iterative learning model that seeks to enhance teaching effectiveness by developing and leveraging prior knowledge and illustrates this approach in the context of IST teaching.

> The most important single factor influencing learning is what the learner already knows. Ascertain this and teach accordingly (Ausubel et al., 1978: 163).

INTRODUCTION

The aim of teaching quite simply is "to make learning possible" (Ramsden, 1992). While much of university education is based on the theory that students will learn if information is transmitted during lectures or if they do things in practicals or seminars, teaching as making learning possible represents a speculative and reflexive activity. This approach to teaching views the students, teaching and the subject to be learned as interactive components of an integrated model. From this perspective, teaching is an iterative process of continuous improvement based on the interactions between the framework components.

One of the main attributes of the student component that influences the learning process is their prior knowledge of material relevant to the subject. A number of research studies indicate that the variance in students' prior knowledge is one of the strongest factors influencing their educational achievement and their understanding of the lecture material (e.g. Beckwith, 1991; Hadwin et al, 1999; Yates & Chandler, 1991). Laurillard (1993) further argues that "it is impossible for teaching to succeed if it does not address the current forms of

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student understanding of a subject". Prior knowledge can have positive and/or negative effects on learning. Pre-existing knowledge has a cumulative impact on individual development thereby accelerating the learning process. However, existing knowledge can inhibit learning if it contains misconceptions (i.e. faulty beliefs or knowledge based on misinformation). In recognition of this twofold impact of prior knowledge, the learning process should be directed so that it 1) builds on positive and consistent prior knowledge and 2) eliminates or reduces the impact of misconceptions.

One of the difficulties in applying a learning strategy targeted at the level of students' prior knowledge is the lack of information regarding these levels. Normally, lecturers receive feedback on students knowledge and understanding through formal assessment at the end of a teaching block. While such post-teaching assessments provide useful indicators of student performance they have a limited capacity for corrective effect on the teaching process. Ausubel at al (1978) emphasises the importance of checking on the prior knowledge – what students bring into a course – and using this to inform teaching. Where the lecturer is unable to accurately ascertain the level of prior knowledge relevant to course content, it becomes difficult for students to successfully participate in exercises that require the application of prior knowledge. Furthermore, since lecturers will often address groups with different levels of prior knowledge this can cause problems in determining the level at which teaching should be targeted (Entwistle, 1998). In an effort to ensure that students have a common understanding of concepts, the lecturer may then find him/herself having to spend valuable lecture time conveying large amounts of information, rather than focusing on higher level goals of analysis and synthesis (Jenkins, 1994). It is therefore important to not only determine existing knowledge but to also ensure that there is an existing level of shared awareness of required concepts.

Finally, Yates and Chandler (1991) argue that possessing knowledge is not equivalent to using this knowledge for achieving cognitive, learning or mnemonic goals. As knowledge is inert, failure to activate prior knowledge in a problem solving environment obstructs the learning process. Willoughby et al. (1993) employ an interrogation technique to activate existing prior knowledge and boost learning. Christen and Murphy (1991) argue that challenging the students to call on their prior knowledge transcends the learning process from memorisation to meaningful learning.

Ramsden (1992) suggests that excellence in teaching requires constant attention to how a subject is being understood by students, and the ability to use the assessment to change instruction so that it more accurately addresses student's errors and misconceptions. This paper is therefore premised upon the need to more accurately understand what students know about a subject (prior knowledge), to enrich their prior knowledge and to use this understanding to inform teaching. The remainder of this paper introduces, in the context of a case study, an iterative learning model that incorporates this process of enrichment, evaluation and activation of prior knowledge on a particular subject or learning unit. This model has been formulated on the basis of a review of literature on prior knowledge and adopted in the context of IST teaching.

THE CASE STUDY

Information Systems and Technology is a year-long undergraduate Level-100 course with a current enrollment of 447 students. There are no pre-requisites (or restrictions) for entry into this course. The student population consists of a cross-section of students: intending majors in Computer Science (CS) or Information Systems (IS); and other-majors (eg. accounting) who want to be IS-literate but not IS-professionals. Some students will take this course having taken or concurrently taking Level-100 courses in CS. Others may be Level-200 of Level-300 IS or CS-majors needing the course to complete the credit requirements for their degree. These characteristics lead to significant differences in the prior knowledge of the student population.

The course aims to develop, in students, an understanding of Information Systems and Technology and its applications to modern business needs including the application of information systems models to the analysis of business situations.[1] A large portion of the lectures are dedicated to the application of knowledge using active participation techniques. It is the experience of the lecturers in this course that the success of active participation within a large class setting is impacted by the aggregate level of content knowledge in the particular subject area. If the aggregate level of content knowledge can be ascertained, then the lecturer is able to balance materials delivery and applied learning. In addition, the level and content of the applied examples can be targeted at the appropriate level.

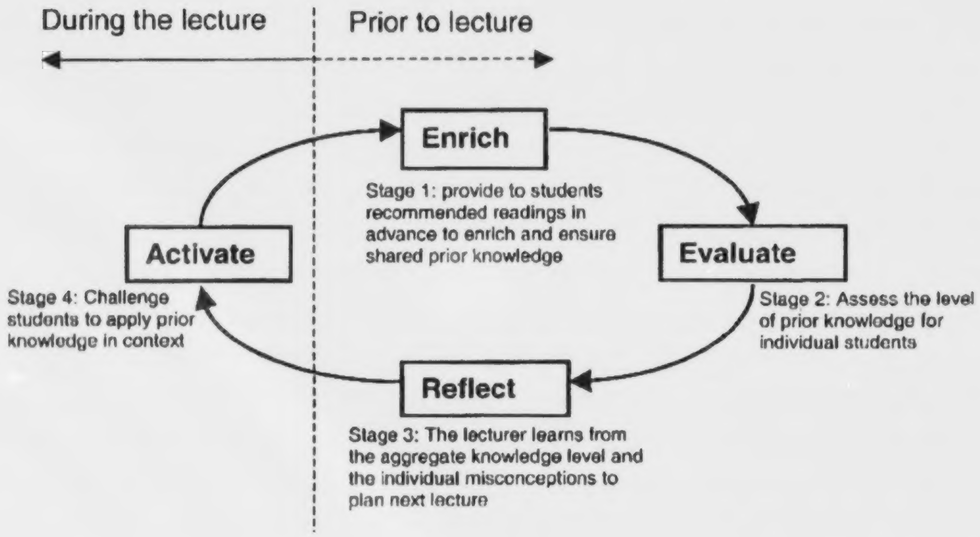
To evaluate prior knowledge, students are required to participate in weekly on-line tests. These tests are accessed via the WWW and are normally available for a week prior to the respective lecture. Students are given 10 minutes in which to complete five (5) randomly selected multi-choice questions. Submissions are marked on-line and feedback is immediate. Students are awarded ½% point for each test; the final mark is based on the best 10 submissions (maximum of 5% in total). Since the final mark is determined using the best 10 of the test sittings, students are thereby encouraged to participate without fear of failure. Approximately 60% of the students complete the weekly on-line tests. Prior to the lecture session, the summarised test results are reviewed by the lecturer to distinguish those topics on which students performed well or poorly. The distribution of incorrect responses for each question is also reviewed. The following section discusses, in the context of the above case description, the adoption of a four-stage iterative learning model that seeks to determine (*enrich*), *evaluate*, and leverage (*reflect* and *activate*) prior knowledge.

THE ITERATIVE LEARNING MODEL

To improve the effectiveness of the teaching process, a four stage evolutionary model of learning is proposed that builds on and utilises students' prior knowledge of relevant material (Figure 1). The model supports the concepts of determination and activation of prior knowledge. In the first two stages of the model, prior knowledge is built and assessed. The third and fourth stages demonstrate how teaching can be adjusted to leverage and activate prior knowledge.

In the first stage (*Enrich*) students are provided with recommended readings for the forthcoming lecture. This encourages students to develop a common knowledge base prior to the lecture. The readings normally consist of both theoretical definitions and facts (declarative knowledge) and problem scenarios (applied knowledge).

FIGURE 1
THE ITERATIVE LEARNING MODEL


During the lecture
Prior to lecture
Enrich
Stage 1: provide to students recommended readings in advance to enrich and ensure shared prior knowledge
Evaluate
Stage 2: Assess the level of prior knowledge for individual students
Reflect
Stage 3: The lecturer learns from the aggregate knowledge level and the individual misconceptions to plan next lecture
Activate
Stage 4: Challenge students to apply prior knowledge in context

To encourage preparation for lectures and to help determine their understanding of such material, in the second stage (*Evaluate*) students are required to take a weekly on-line (WebCT-based) test. While the technique of on-line testing is not new, these tests focus not on an assessment of students' understanding of *taught* material, but on determining the students' prior understanding of forthcoming material and using this to inform teaching. An analysis of the responses contribute to a better understanding of students' prior knowledge, and their errors and misconceptions. The process of *evaluation* also provides an incentive (by way of credit) that encourages students to prepare for lectures *(enrichment)* and participate in on-line testing.

In the third stage (*Reflect*), the lecturer's understanding of students' prior knowledge is used to inform teaching practice in the lecture sessions (Ausubel et al, 1978). While assessment often provides feedback to students on how they should learn (or have failed to learn), this form of assessment is designed to provide feedback to teachers on how to teach. The lecturer is able to tailor the session to appropriately balance content delivery, clarification of misconceptions, and analysis and application of concepts. In the context of the case study, the summarised results from the on-line tests are reviewed and appropriate annotations and emphases are made to the prepared lecture. The lecturer is then able to place additional emphasis on the material that students did not grasp as well as correct misconceptions in prior knowledge.

The final stage (*Activate*) of the Iterative Learning Model involves the activation of prior knowledge. During the lecture, students are challenged to recall prior knowledge as they apply it to problem-solving scenarios and link new concepts to pre-existing ones. Activation of knowledge allows the students to appreciate "how and when existing mental elements can bear upon new demands" (Yates and Chandler, 1991). The declarative knowledge accumulated through prior reading is transformed into procedural knowledge that is bound by context (e.g. through case-based scenarios). This further enriches student knowledge in the subject area and creates a progressive accumulation of knowledge. Hence, learning becomes an iterative process.

CONCLUSION

The knowledge that students bring to the lecture is one of the most important factors influencing their learning. Since effective teaching is that which makes learning possible it is of great importance that lecturers understand the level of the students' prior knowledge and target their teaching accordingly. This paper has proposed an iterative learning model that aims to improve teaching effectiveness by building and leveraging the prior knowledge of the learner. The model has been adopted in the context of teaching and learning in IS education. Based on the iterative learning model, this paper describes a technique (through on-line testing) that can help determine and leverage the prior knowledge of students, for informing teaching. Future research could undertake an analysis of the impact of this approach on teaching effectiveness as measured by student understanding, motivation and performance.[2]

END NOTES

1. Source: Department of Accountancy, Finance and Information Systems: Undergraduate & Graduate Courses 2000, University of Canterbury, NZ, p. 12.

2. It is expected that preliminary results of the impact of on-line testing on teaching effectiveness and student learning will be available at the end of the 2000 academic year.

REFERENCES

Ausubel, D. P., Novak, J.S., and Hanesian, H. (1978). *Educational Psychology: A Cognitive View*. Holt, Rinehart & Winston: New York.

Beckwith, J. B. (1991), "Approaches to Learning, Their Context and Relationship to Assessment Performance," *Higher Education, 22*, 17-30

Christen, W and T. Murphy (1991), "Increasing Comprehension by Activating Prior Knowledge," *ERIC Clearinghouse on Reading and Communication Skills*, Bloomington, IN.

Entwistle N. (1998). Improving Teaching Through Research on Student Learning. In Forest J.J.F. (ed.) *University Teaching: International Perspectives*, Garland Publishing: London, 73-112.

Hadwin, A., Kirby, J. and R. Woodhouse (1999), "Individual Differences in Notetaking, Summarization, and Learning from Lectures," *The Alberta Journal of Educational Research*, *35*, 1-17.

Jenkins, A. (1994) "Active Learning in Structured Lectures" in G. Gibbs and A. Jenkins (eds.) *Teaching Large Classes in Higher Education*, Kogan Page, London.

Laurillard, D. (1993). *Rethinking University Teaching: A Framework for the Effective Use of Educational Technology*. Routledge: London.

Ramsden, Paul (1992). *Learning to Teach in Higher Education*, Routledge: London.

Willoughby, T., Waller, G, Wood, E and G. MacKinnon (1993), "The Effect of Prior Knowledge on an Immediate and Delayed Associative Learning Task Following Elaborative Interrogation," *Contemporary Educational Psychology, 18*, 36-46.

Yates, G. and M. Chandler (1991), "The Cognitive Psychology of Knowledge: Basic Research Findings and Educational Implications," *Australian Journal of Education, 35*, 131-153.

THE RADICAL MODEL — A PAINLESS WAY TO TEACH ON-LINE

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ABSTRACT

The IT/IS education sector needs to come up with creative ways of thinking about on-line education. In this paper, the major themes in the literature on on-line education to date are highlighted with a view to identifying issues that are either missing or under-emphasised. Next, the "radical model of on-line teaching" is presented. The paper is concluded with a discussion of how the model addresses some of the issues that are missing or under-emphasised in the literature.

INTRODUCTION

On-line education can be defined as teaching and learning activities enabled by electronic media. Given its reliance on emerging technologies, it is a relatively new area of research and practice for IT/IS educators. At the same time, the unique expertise that IT/IS educators have and the crucial importance of this area for the higher education sector in general, creates a situation where in many universities IT/IS academics are called upon to lead the transition of their universities to on-line education.

As part of this new role, it is also IT/IS educators who are expected to champion on-line teaching by being the first to use it in their own teaching. It is expected that based on their personal experience with this teaching mode, they will be able to disseminate knowledge about it to their less computer literate colleagues. It is also expected that based on their experiences as early adaptors and champions of this practice, they would be able to teach the rest of the academic sector how to do on-line teaching painlessly and more effectively.

It is for this reason that the IT/IS education sector needs to come up with creative ways of thinking about on-line education. Doing so will not only improve our own practices but help us enlighten others within the higher education sector on how to avoid our mistakes.

WHAT ARE THE MAJOR EMPHASES IN THE CURRENT LITERATURE ON ON-LINE TEACHING AND LEARNING?

The literature on on-line education to date seems to emphasise a number of themes:

The Advantages and Disadvantages of Teaching On-line

A major theme in the literature on on-line education is the advantages and disadvantages of this practice. Cost effectiveness and flexibility, particularly for students, are often mentioned as the major advantages of on-line teaching (West, 1998; Cunningham, 1998). While, "second rate" education and extra work for the lecturer are mentioned as the major disadvantage (Cunningham, 1998). There is general agreement in the literature, however, that no matter what the disadvantages are, the cost-effectiveness of on-line education is so compelling that it is bound to be the way of the future for universities (Cunningham, 1998; Ryan, 1998; Flew, 1998; Thomas, Meredyth, and Blackwood, 1998 and others).

The Range of Technologies for On-line Teaching

Another important theme in the literature on on-line education is a discussion of the ways in which it can be accomplished. In particular, the publications in this area contain descriptions of teaching situations (quite often borrowed from the face-to-face mode) that lend themselves to the on-line mode. For example, lecture notes can be placed on the class web site (just like distribution of these notes to the students in the face-to-face mode), students can submit assignments and be tested on-line, on-line multimedia packages can be developed to guide students through the major components of a subject area (e.g., teach students how to use a software). There is also emerging literature on how video and audio conferencing can support teaching and learning and some literature on how chat groups can be used to support teaching or as the basis for class interaction (West, 1998; Ryan, 1998; Cunningham, Tapsall, Ryan, Stedman, Bagdon, and Flew, 1998; Kelly and Shing Ha, 1998; Tsang and Fong, 1998).

The Profound Changes to the Role of the Lecturer as a Result of On-line Teaching

It is implied in the literature that on-line teaching heralds a new role for academics, with a stronger emphasis on the lecturer as provider of mass education and a lesser emphasis on his/her role as creator of new knowledge or as a researcher. This theme often leads to the conclusion that in the future academics will be expected to engage in less research and more teaching.

WHAT IS MISSING IN THE CURRENT LITERATURE?

A careful reading of the literature in this area seems to suggest that several themes are either missing or under emphasised in this literature. These themes include:

A Relative Under-emphasis on the "Many to Many" Mode of Student/lecturer Interaction

The discussion of on-line learning seems to suggest three modes of interaction between lecturer and students which are mutually exclusive:

"One to one". When students are reading materials on the class web site, getting assessed on line or working with an on-line tutoring package, they are basically interacting with the material on a one to one basis.

"One to many". When students are in an audio or video conferencing situation, as well as when they communicate directly with the lecturer through the telephone, or perhaps when they read materials that are updated occasionally by the lecturer on the class web site, they can be said to interact in a "many to one" or "one to many" mode.

"Many to many". When students are involved in discussion with other students as part of the class regular interaction or as an activity that is supporting the learning process, it would be an example of the "many to many" mode of interaction.

In contrast to the first two modes of on-line interaction, the "one to one" and "one to many", that seem to be predominant in the current literature on teaching on-line, the third mode, the "many to many", is not as frequently practiced as part on-line teaching. Even when this mode is practiced, it is more than likely to be seen as a parallel process to the **real** teaching, intended to "keep the students motivated". Thus, when the "many to many" mode is practiced it is not used as a teaching activity on its own (where students present their work, comment on other people's work, and get their work assessed on line) but rather as an enhancement of the real teaching, which takes place in the "one to one" or "one to many" mode.

An Under-emphasis on the Soft Knowledge/Skills

A study (Lee, Trauth and Farwell, 1995) based on combined input from industry and academia, concluded that four major clusters of knowledge/skills will be required of IS personnel in the next few years:

1) *Technical Specialties Knowledge/Skills*: including: operating systems, programming languages, database management systems, networks, telecommunications, etc.

2) *Technology Management Knowledge/Skills*: including issues such as where and how to deploy information technologies effectively and profitably for meeting strategic business objectives.

3) *Business Functional Knowledge/Skills*: including how to re-engineer business processes before the

adoption of a new information system to produce maximum benefit from the system.

4) *Interpersonal and Management Knowledge/Skills*: which relates to the "boundary-spanning" role of information systems personnel. This role requires IS professionals to master interpersonal skills such as "selling," "negotiating," "leading," and "counselling."

It is worth noting that three of the four knowledge/skills clusters identified by Lee et al, namely, technology management, business knowledge, and interpersonal skills are not the "hard skills" traditionally associated with IT/IS education. These three clusters can be described as "soft" because they emphasise an understanding and ability to work with people rather than machines. The authors also report that while business managers are reasonably satisfied with the skills that IS graduates have in the "hard" areas, they are dissatisfied with the students' knowledge and ability to apply the soft skills. They conclude that it is the soft skills that need more attention from IS educators.

Given the importance of soft skills in IS education, the question arises how can they be most effectively taught? Given that these skills are related to interpersonal interaction, it would seem logical that the best way to teach them if not face-to-face, would be through the many to many mode. Obviously, the overemphasis on the one to one and one to many mode of interaction in the on-line teaching practice results in an over-emphasis on hard skills and under-emphasis on the soft skills needed by IS/IT professionals.

An Under-emphasis on Flexibility for the Lecturer

Much of the current discussion about on-line learning and teaching emphasises the flexibility that results from this mode of learning to students. Students are supposed to be able to leam any time, and anywhere (as long as they have access to the Intenet). They are supposed to be able to not purchase books (if the course materials are available for them on the class Web site) or other teaching materials. Given the cheaper price of on-line education, it is supposed to be available to all students, irrespective of income, socio-economic level, gender, family status, or professional activities. In fact, the general assumption is that on-line education would make it possible for full time employees to do their studies "flexibly" in between all their other daily activities without major investment in either time or energy.

In contrast to the above, there is almost a universal agreement in the literature, that on-line teaching results in less flexibility and more work for lecturers. In fact it would be true to say that the increased flexibility for the learner is seen as associated with a decrease in flexibility for the lecturer. It is precisely for this reason that on-line teaching, as a major new activity for lecturers, is associated with the belief that academics in future will be disseminators of knowledge (teachers) rather than creators of knowledge (researchers).

WHY DO WE NEED TO BE CREATIVE ABOUT ON-LINE EDUCATION?

If we are to think creatively about on-line teaching and learning, we would have to address the three issues, outlined above, that are currently missing from much of the thinking in this area. In other words, our future on-line teaching models should incorporate ALL modes of interaction (including the "many to many"), ALL knowledge/skills clusters (including the soft skills) and the interests of both lecturers and students. If this new education practice is to succeed, it would have to be cost effective to both lecturers and students. It will also have to be inherently motivating to both students and lecturers, and organisationally viable.

There are obviously different ways to reach this goal. In the following sections an approach to on-line education that is currently practiced by some faculty in the Faculty of Informatics and Communication is presented. This model has been used with a range of courses, including small post-graduate courses (with up to 20 students) and large under-graduate courses (with up to 100 students). The students are a combination of on-campus and distant learners. Both groups are treated as one homogenous group, which means that the course does not have any face-to-face teaching.

To date, this model has been used to teach courses in Management of Information Systems and Electronic Commerce. Student responses to this model have been so positive that even though the thinking about it is still evolving, the authors believe that it is ready to be shared with others.

The "Radical" On-line Teaching and Learning Model

The teaching materials for the Radical Model of On-line Teaching (irrespective of what area is being taught) include:

- a video which contains detailed explanations from me on how the course is run;
- a ten-page booklet "Course Outline" which describes all necessary information about the course(it is available on line as part of the course's Web site and is provided to the students on a CD ROM and on hard copy);
- a textbook; and
- a class e-mail list.

The first thing that students are expected to do once they read the Course Outline and watch the video is subscribe to the class e-mail list. They are then expected to introduce themselves to the class on-line so they can be divided into weekly presentation groups. The allocation to groups is completed by the second week of the semester. By this time, students are expected to establish contact with their virtual group members and start working on their assessment tasks. On week 3 of the semester, the first group makes its presentation to the class on-line. The presentation consists of an article (which the students have to enclose, attach, or simply establish a hiper-link to) and a critique that links the article with the reading in the book for the week.

The presentation is expected to be made on Tuesday of each week. By Friday, each of the groups in the class is supposed to comment on the presentation. On Sunday, the presentations for the week are read by the instructor along with the comments that were made by all the groups. All groups are marked every week for either their presentation or their comments about other students' presentations. This procedure is repeated for ten weeks until the end of the semester, with each week dedicated to an in-depth discussion on a **different** topic that is related to the reading for that week.

What Are the Advantages of this Approach and Why It Should Be Considered Radical

This approach encompasses the best of all three modes of student/teacher interaction. Students have some interaction with the material (when they read the book and the articles that are presented by the other groups). They have some interaction with the lecturer, through direct correspondence on e-mail and the replies to them about their presentations on the class list. However, the major bulk of their interactions is in the "many to many" mode, with the other students in their presentation groups and with the rest of the students in the class through the class e-mail list.

Throughout the semester, students are assessed on 11 assessment tasks (including their group presentation, comments on other students' presentations and an end of term exam). For each presentation that they make, they get (if the class consists of 100 students) 19 comments which represent the views of their own group members (in this case, there will be 10 members per group) as well as all other 90 students in the class. Since this procedure is repeated every week, the students receive over 100 inputs from their group members, the other groups, and from the lecturer by the end of the semester.

It should be noted that even though class interaction is the means through which teaching takes place, the radical model does not result in the list being flooded by e-mail messages. Students are instructed to refrain from using the class list for unlimited expression. The place for such interaction is supposed to be the small presentation groups which they establish to support their group work. The messages that end up being posted on the class list are messages from the list moderator (the lecturer) "formal" presentations of the students' work, and comments by the other groups about these presentations.

This approach encompasses both hard and soft knowledge/skills. In addition to learning about the content area for the semester, students learn important on-line skills such as how to set up their e-mail lists, how to be citizens of an on-line community, and how to contribute to a virtual team, including dividing the work between the team members, resolving conflicts, developing ideas and projects, and providing positive feedback to others about their work.

Through the involvement of students from diverse backgrounds (many of whom are fully employed) students learn about how organizations use the abstract concepts that are mentioned in the readings. They also learn about relevant legislation and ethical issues.

This approach is flexible for both lecturer and student. The flexibility to the students, which has been discussed before, is increased in this approach because the students don't have to submit hard copy assignments (hence, nothing can get lost through the system). They get to know if their submission was successful immediately when they see it posted on the class list. As well as this, if something happens to preclude an individual student's contribution during the semester, he or she can negotiate with their group members on how they can take time off and compensate later by doing more work for the group. In fact, students don't need to ever negotiate with the lecturer on late submission, special consideration, etc. All negotiations on these issues are carried out within the group.

Students have further flexibility in not having to download large amounts of data from the class Web site (there is nothing on the web site other than the Course Outline). They don't need to buy any books other than the course textbook, and even this book can be shared between them up until the end of the semester, as all assessment tasks are group based. Because all learning is facilitated by the class list, the students can engage in class activities from home, work, or while travelling. Further flexibility to the students is provided through the students' selection of supplementary readings for class discussion by **themselves**. As a result, students get to read quite a large number of articles on topical issues that are of interest to them rather than forced to read articles selected by the instructor.

Lecturer flexibility is also an enormous benefit from the radical model. Since the package for this course does not include a Study Guide, there is no need to update one every semester. Since the course is in no way dependent on a textbook, there is no need to modify or change it in any way if and when there is a need to change a textbook. In fact, preparing study materials for a new semester should not take more than a few minutes, given that nothing substantial has to change.

As for on-going teaching; reading the weekly presentation and the comments by the other groups (students are restricted to two pages or two screens maximum per critique or comment on other people's critique), takes about an hour and a half to two hours per week. This can be done from anywhere, including from home or from a conference. Theoretically, even if the lecturer is totally incapacitated, another person can easily take over and do the on-going weekly assessment, without inconveniencing the students.

Note that this design is also advantageous from a legal perspective. Since articles by other authors are not used as part of the course Web site, there is no infringement on other people's copy-rights.

The most important aspect about this model is that no matter how many students are in the class, the amount of work for the lecturer is the **same**. No matter how many students are in the class, 10 or 100, the lecturer ends up checking 10 presentations of one page each per week for ten weeks. If the class consists of 10 students, these 10 pages of text represent the work of each of them. If the class consists of 100 students, the ten pages will represent the work of the ten groups into which the students have been divided. Thus, the amount of marking for the lecturer remains the same, irrespective of the number of students in the class.

This approach can be enhanced by other means, of course;

1) class interaction can be supported by audio or video-conferencing (In this case differences in time-zones between different locations where students were located around the world prevented this application);

2) submissions can be made via the telephone (for example, students can tape role plays in a class on interpersonal communication and submit these to a voice mail box where they can be listened to and commented on by the other groups in the class);

3) class assessment can be complemented by on-line testing (this has not introduced so far in this situation);

4) teaching can be enhanced by on-line tutoring; and at least part of the interaction with the students can be undertaken through the class Web site, rather than on the class list.

Other improvements to this approach could involve a class management system which would allocate students to groups and establish group lists for them. Currently in the absence of such a system, the allocation of students to groups is conducted manually and students establish their groups on their own. It would seem that a class management system and/or the use of team teaching would be necessary once the number of students in a virtual class where this model is applied goes beyond 100. If this were to happen, the model could be easily duplicated, with more than one lecturer facilitating the learning process.

However, even without these enhancements, important lessons from use of the Radical Model are that this approach does not result in more work for the lecturer or in inferior education for the students. Student comments are very enthusiastic and they consider this format an improvement over the usual hard copy distant education packages. They also consider it superior to many of their face-to face-courses, where the "one to many" or "one to one" modes are practised.

REFERENCES

Cunningham, S, "Technology and delivery: assessing the impact of new media on 'borderless' education", *Australian Universities Review*, 1, 1998, pp.10-13.

Cunningham, S., Tapsall, S., Ryan, Y., Stedman, L. Bagdon, K. and Flew, T. *New Media and Borderless Education: A Review of the Convergence between Global Media Networks and Higher Education Provision*. Department of Education, Training and Youth Affairs, Evaluations and Investigations Program. Higher Education Divison, Canberra, Australian Government Publishing Services, 1998.

Flew, T. "Fast times at virtual U: digital media, markets and the future of higher education in the West Report", *Australian Universities Review*, 1, 1998, pp. 20-25.

Kelly, M. E. and Shing Ha, T., "Borderless education and teaching and learning cultures: the case of Hong Kong", *Australian Universities Review*, 1, 1998, pp. 26-33.

Lee, D. M. S.,-Trauth, E. M. and Farwell, D. "Critical skills and knowledge requirements of IS professionals: a joint academic/industry investigation", *MIS Quarterly*, 19, 1995, pp. 313 - 340.

Philip Tsang and TL Fong "Learning support via the Web: how do I know it made a difference", *Proceedings of the 12th Annual Conference of the Asian Association of Open Universities*, 4 -6 November, 1998, pp.419-424.

Ryan, Y. "Time and tide: Teaching and learning online", *Australian Universities Review*, 1, 1998, pp. 14-19.

Thomas, J., Meredyth, D. and Blackwood, L. "The opposite of choice: new technologies and new markets in Australian education", *Australian Universities Review*, 1, 1998, pp. 34-40.

West, R. (Chair) *Learning for Life: Final Report, Review of Higher Education Financing and Policy*, Department of Education, Training and Youth Affairs, Evaluations and Investigations Program. Higher Education Division, Canberra, Australian Government Publishing Services, 1998.

A REVIEW AND ASSESSMENT OF TEACHING COBOL IN AN IS PROGRAM

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ABSTRACT

Academic programs undergo periodic review and assessment. Reasons include requirements of accrediting agencies and a need to maintain competitive advantage in attracting students. In addition, IS programs face a rapidly changing environment. One area of interest in IS programs is the set of programming languages offered. These languages should be in step with the IS environment, other computer programs at the institution and the student audience. In particular, the offering of Cobol as a required language must be reviewed carefully.

This study of an IS program's Cobol requirement at a small private liberal arts college examines the background described above. The IS environment is investigated through a survey of job advertisements in a selection of on-line newspapers and employment services. In addition, a brief survey of language offerings in over 90 IS programs throughout the world is presented. An informal review of technical book offerings at a mega bookstore is also presented. Finally, the student body is described and an assessment of Cobol is given.

INTRODUCTION

Academic programs offered by a college or university undergo periodic review and assessment. There are many reasons for initiating this process. A major one is that many institutions seek to maintain accreditation granted by regional and state agencies. These agencies conduct periodic reviews of institutions and their programs. In particular, regional accrediting agencies in the United States – such as Middle States – are placing an increasing emphasis on institutions to review their programs, assess the quality and use this review and assessment to modify their programs in light of their mission. This process has been labeled "outcomes assessment."

A second reason for carrying out a periodic review and assessment is that in the United States institutions face an increasingly competitive academic market. In any region there are many institutions at all levels – from junior colleges to universities. Most offer a similar array of programs to what has been a shrinking number of prospective freshmen. The growth of distance learning programs provides additional competition and removes the traditional geographic boundaries. Institutions must periodically review and assess their programs to maintain currency and attractiveness.

These reasons for program review and assessment – the requirement of accrediting agencies and a need to attract students – apply in general to any programs. A third reason – a rapidly changing environment – compels individual programs. In particular, the IS environment is changing rapidly and has been doing so since its birth in the middle part of the 1900s. In order to continue to offer courses that provide an understanding of and tools for this changing environment, IS programs must undergo periodic review and assessment.

One area of interest is the set of programming languages an IS program offers. There have been many programming languages. Some, like APL, have had a short shelf-life while others, like Fortran and Cobol, seem to live forever. The particular languages an IS program offers should fit with the outside IS environment, computer offerings of other department at the institution, and the type of student the program attracts.

Cobol has long been a mainstay of IS programs. But newer, more popular languages compete for a limited number of course offerings at many institutions. It is thus important to ask the question: "Should we continue to require that IS students take Cobol?"

THIS STUDY

The author selected the following languages to examine: C++, Visual Basic, Cobol, Java and Html. While the last is not strictly a programming language, it is offered by many programs.

The IS Environment: The Job Marketplace

In the past surveys have used classified ads to identify IS skills in demand. An Annual Skills Survey undertaken by *ComputerWorld* (*ComputerWorld*, 1998), found the following % of companies hiring for these skills for 1999:

Cobol	Visual Basic	C++	Java	Html
17%	16%	13.25%	13%	14%

A recent survey (Papp, 1999) that focussed on the New England area found the % of ads mentioning these languages as follows:

Cobol	Visual Basic	C++	Java	Html
16%	10.75%	13.25%	5%	3%

For this study, a brief survey was undertaken of jobs available through on-line newspapers and employment services. The newspaper selection included: The Washington Post, The LA Times, The New York Times, and The Atlanta Journal-Constitution. Employment services included hotjobs.com and monster.com. The jobs were compiled on March 20, 2000. Results are presented in Table 1.

TABLE 1

Source	City	Cobol	Visual Basic	C++	Java	Html
Hotjobs.com	DC*	2	48	107	126	121
	LA*	31	153	11	4	13
	NYC*	81	341	9	7	9
	Dallas*	18	82	245	237	280
	Atlanta*	17	101	256	265	233
Monster.com	DC*	19	173	608	448	1000++
	LA	113	498	1000++	1000++	1000++
	NYC	80	384	1000++	1000++	1000++
	Dallas	68	450	1000++	1000++	1000++
	Atlanta	21	79	290	1000++	1000++
Washingtonpost.com	DC*	195	955	5616	1857	1780
Latimes.ocm	LA*	6	36	47	44	38
Nytimes.com	NYC*	12	33	836	106	73
Ajc.com	Atlanta*	4	15	31	33	22

Notes: * indicates metro area. 1000++ indicates maximum reported by monster.com.

Many of the above sources list the most jobs for C++, Java and Html. Hotjobs.com indicates a top market for Visual Basic in the DC, LA and NYC metro areas. Note that Cobol jobs are still available, though other languages in most cities dwarf its numbers.

These studies show the demand for Cobol jobs and skills have decreased. While regional differences may account for some of this decrease, the Y2K problem has come and gone and presumably removed a large source of the need for Cobol programmers. But there are still jobs for Cobol maintenance programmers. The Internet has grown tremendously and has fueled the need for Java and Html programmers. A final note – it may be worth examining differences between an on-line source and its hardcopy relative.

A Very Informal Survey of Technical Books at a Mega Bookstore

While the following study was lightly undertaken, the results support those found in the study of jobs from on-line sources. A mega bookstore in a New York City suburb was visited. Their extensive technology section carried books on a variety of programming languages. In this survey the number of shelves per books of a given language was counted. A shelf held about 35 books. Results are shown in Table 2.

TABLE 2

Cobol	Visual Basic	C++	Java	Html
0.5	7	8.5	13	4

For those who believe that there will always be some books available for any particular language, the author offers the following observation: this store carried no Pascal books, neither on shelf nor in the computerized lists of books to stock.

A Survey of Programming Languages Offered in IS Programs

Through the listserv of ISWorld, a survey was emailed to 2415 recipients. 90 responses were received from 79 institutions. Results are shown in Table 3.

Visual Basic has the most offerings, followed by Cobol and Java. Html and C++ have the least. Note that the course offerings in this survey do not proportionately match job advertisements. It may be argued that academic programs respond slowly to a rapidly changing business environment, but the demands for periodic review and assessment of IS programs discussed previously in this paper suggest there are more compelling reasons for this discrepancy. Some of these reasons are considered in the next section.

The Mission of a Particular IS Program and Its Student Body

The author teaches at a small private college in a New York City suburb. While the college has a School of Business that houses the IS department, it is primarily liberal arts and sciences. With an open admissions policy, the college attracts many part-time students who tend to be older than the norm. These are non-traditional students; many hold jobs. Many are the first in their families to go to college. There are 125 IS majors from an undergraduate population of 4000.

The IS faculty examine the language offerings regularly. In addition to the periodic review required by Middle States, every department at the college invites an outside evaluator to examine their programs and offer recommendations for improvement. This is done every four years. In 1995 we required a two-semester sequence in Cobol; this was changed to one course in Cobol and one in Visual Basic.

The IS program covers 10 courses. The Cobol and Visual Basic courses are taken after a one-year sequence of computer literacy courses. IS is a difficult major for many students. Of all the courses, the two programming courses are most challenging. In particular, the Cobol course acts as a gatekeeper. More than 25% of the students attempting that course do not pass. Those that pass Cobol almost always pass the other IS courses.

We have considered the more popular languages with higher career potential: C++, Java, Html. Thus far we have decided to continue with Cobol and Visual Basic. Our reasons are as follows. Cobol is not yet a dead language. There are jobs and books available. In addition, it is more common for an IS program to offer

Cobol than it is to offer C++ or Html, and as common to offer Java.

TABLE 3

Course	# Institutions Offering	# Courses Offered	Required	Elective
Cobol	43	50	32	18
Visual Basic	65	69	56	16
C++	40	45	36	26
Java	48	50	31	31
Html	46	46	25	24

Notes:

a. In some cases a course is required or elective but offered by another department.

b. In some cases a course is one of a group of which a few are required.

c. In some cases a course is required in one track and elective in another.

d. In some cases a colleague noted that a course was offered, but didn't note whether it was required or elective.

e. Html was often offered as part of a course.

f. In cases where there was more than one response from an institution, responses sometimes conflicted.

g. A prize goes to a New England institution that offered and required one course that covered every one of these languages.

Cobol is a very structured language and teaches a structured programming style. It is very concrete and students find it less difficult than the more abstract languages such as C++ or Java. A Computer Science program at our college offers C++ and Java. The IS program often attracts Computer Science students who find their languages too difficult and manage more easily with Cobol and Visual Basic. At this point in time, if we were to substitute C++ or Java for Cobol, the course might become more than a gatekeeper, it might become a wall scalable by very few students. We don't want to decimate our majors. On the other hand, we want to offer our students courses they will find valuable for career preparation. Cobol remains a useful language. It helps to train students in the rigors of programming, introduces them to structured concepts, and provides a concrete vocabulary that is more easily understood than the more abstract programming languages.

A final consideration is that our students do not typically become programmers. While we want them to understand what programming in a 3GL is about, we are not terribly concerned with a decreasing job market in Cobol. The few students who show high aptitude for programming are encouraged to take C++ and Java as electives.

SUMMARY

This paper has reviewed the languages offerings of a small suburban IS department in light of the reasons for this review. A present survey of available jobs indicates a high demand for C++, Java and Html programmers, a strong demand for Visual Basic and a low demand for Cobol programmers. These findings are mirrored in the availability of technical books. The offerings of other IS programs reveals a different picture. In 79 institutions there are a large number of Visual Basic courses offered, moderate numbers of Cobol and Java courses, and slightly fewer C++ and Html courses. These findings suggest that institutions justify their language offerings in terms other than high job availability. In particular, Cobol can be seen to have a better fit with a particular student audience than C++ or Java would. The IS program under study is planning to stay with its languages offerings of Cobol and Visual Basic for the immediate future.

REFERENCES

On Assessment:

"Framework for Outcomes Assessment," Commission on Higher education, Middle States Association of Colleges and Schools, 1996.

"Outcomes Assessment Plans," Commission on Higher education, Middle States Association of Colleges and Schools, 1998.

Other Surveys:

"Fifth Annual Skills Survey", *ComputerWorld*, 1998 http://www.computerworld.com/home/features.nsf/all/981116skills2

Papp, R., "Technology Skills in Demand: A survey of Job Advertisements in New England," *Proceedings of the Thirteenth Annual Conference of the International Association of Information Management*, Helsinki, Finland, 1999.

EXPERIENCES ON USING A BUSINESS GAME AS PART OF AN INFORMATION SYSTEMS COURSE

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ABSTRACT

This paper describes an experimental teaching case used in an information systems course of a business university. In this teaching case the students were taught through the use of a real-time processed business game how typical business processes unfold. We were especially interested in giving the students perception on the holistic structure of organisational processes and the balance between different functional demands. The case exercise confronted some problems, both technical and organisation. This paper describes both the theory supporting the use of computer-based learning environment, the tools used in the case exercise, and the student survey results from the teaching case. The results of the study are preliminary and further research about the topic needs to be done in the future.

INTRODUCTION

Today, the information needs of decision-makers are likely to change rapidly. Instead of improving information about what goes on inside an organization decision-making will increasingly require information about competitors, new producing technologies, new delivery channels, and so on. The development of decision-making skills of employees in any business organization is a major challenge for businesses. In this process of continuous changes the teaching methods play a considerable role. Besides of the changes in different business environments the higher-level business education is in a state of change. Aram and Noble (1999) argue that business schools are not adequately preparing students to understand and cope with the levels of ambiguity and uncertainty they will inevitably face when they take up positions in organisations. They believe that this is occurring because the models of teaching and learning that dominate academic practice are those that are appropriate to the stable, predictable aspects of organisational life and do not include the paradoxical and unpredictable.

We feel that this same demand concerns also both to information systems professionals and information systems education. Information systems professionals are often in positions where it is essential to deal with issues concerning the interest of organisations as whole. Thus, these professionals need to understand the holistic structure of organisational processes and be able to balance between different functional demands. Lee et al. (1995) note that the IS industry will demand IS professionals with knowledge and skills in technology, business operations, management, and interpersonal skills to effectively lead organisational integration and process reengineering activities. Thus, the requirements for IS professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge.

In this paper we are discussing an experimental training case where students in an information systems course were to deal with business process identification through using a business game model. The experiment was a simple one and confronted some setbacks. However, we feel that the experimentation as one way of arranging IS education is worth reporting.

THEORY SUPPORTING THE USE OF BUSINESS GAMES IN TEACHING

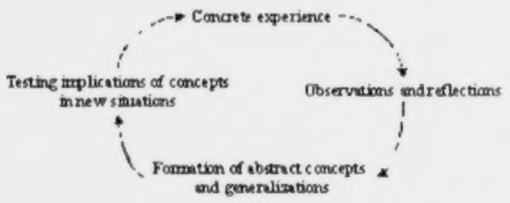
Computer simulation involves experimentation on a computer-based model of some system (Pidd, 1998). The model is used as a vehicle for experimentation, often in a 'trial and error' way to demonstrate the likely effects of various policies. Those policies, which produce the best results in the model, would be implemented in the real system. According to Bunge (1973) the purpose of using simulations is to gather understanding of the original object by studying the behaviour of the simulation: without analogy there might be no knowledge; the perception of analogies is a first step towards classification and generalisation. On the other hand, Bunge (1973) warns us about the inability to distinguish analogy from equivalence. Bunge mentions that an illusion of perfect formal analogy can be produced only in special cases.

Business game is a special type of simulation in which human participants act as decision-makers within the framework of the system being simulated (Naylor, 1979). Ju and Wagner (1997) mention that the nature of business games can include decision-making tasks, which pit the player against a hostile environment or hostile opponents. Business games have the nature of strategy games, but usually are very terse in their user interface. Other types of managerial simulations are resource allocation games in which the player or the players have to allocate resources to areas such as plant, production, marketing, and human resources, in order to produce and sell goods.

Computer-based learning environments (**CBLE**) like business games - build on a long tradition of experiential education theory (Isaacs and Senge, 1992). This theory points to the significance of learning through direct experience opposed to learning through 'instruction'. In experiential education theory learning is said to occur through the resolution of conflicts over different ways of dealing with the world.

Kolb (1984) describes three slightly different models of experiential learning. The model Kolb calls Lewinian model is an integrated process that begins with here-and-now experience followed by collection of data and observations about that experience. The data are then analysed and conclusions of this analysis fed back to the actors in the experience for their use in the modification of their behaviour and choice of new experiences. Thus, in this model learning is conceived as a four-stage cycle shown in Figure 1. Immediate concrete experience is the basis for observation and reflection. Observations are assimilated into a theory from which new implications for action can be deduced. Implications or hypotheses then serve as guides in acting to create new experiences.

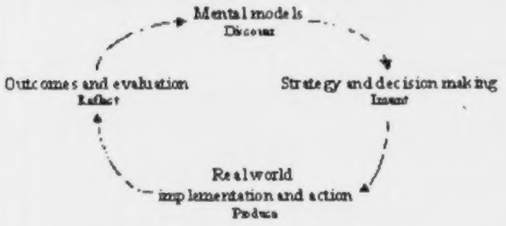
FIGURE 1
THE LEWINIAN EXPERIENTIAL LEARNING MODEL BY KOLB (1984)


Concrete experience
Testing implications of concepts in new situations
Observations and reflections
Formation of abstract concepts and generalizations

Kolb (1984) notes that the emphasis is on here-and-now concrete experience to validate and test abstract concepts. Kolb argues that immediate personal experience is the focal point for learning. This experience gives life, texture, and subjective personal meaning to abstract concepts and at the same time provides a concrete, publicly shared reference point for testing the implications and validity of ideas created during the learning process. The second emphasized aspect of this learning model is that training is based on feedback processes (Kolb, 1984). The information feedback provides the basis for a continuous process of goal-directed action and evaluation of the consequences of that action.

Also Argyris and Schön (1978) have described this process with slightly different terms. In their model the process moves from discovery of problems, to invention of solutions, to production of solutions in action, to reflection on the impact of these actions, and then back to discovery. Isaacs and Senge (1992) argue that if this learning cycle operated effectively, new insights about the real world would be continually discovered and embedded in improved mental models. Decisions would be invented based on new mental models, those decisions would be enacted and then outcomes would be reflected upon to produce new insights.

FIGURE 2
CBLE LEARNING CYCLE BY ISAACS AND SENGE (1992)


Mental models
Discover
Strategy and decision making
Invent
Real world implementation and action
Produce
Outcomes and evaluation
Reflect

Isaacs and Senge (1992) mention that the designers of CBLEs argue that the ideal learning cycle fails to operate effectively in organizations because of limits at each point in the cycle (these limits affecting the ideal learning cycle are embedded to the cycle in Figure 3.):

1. Decision-makers have diverse and typically tacit mental models, making the development of strategies a process of negotiation among competing recommendations, not a rational comparison and testing of alternative assumptions.

2. Delays between when decisions are made and their impact may be very long, often many years for strategic decisions.

3. Additional delays between action and perceived consequences arise because of the time needed to collect, disseminate and interpret data.

4. Actions taken in one area may have significant effects in distant parts of the system, but these effects may obscure to the original actors. Thus, decision-makers cannot see the consequences of their decisions.

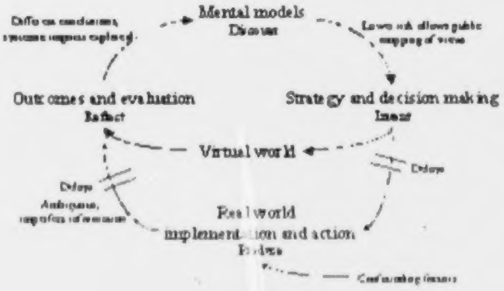
5. Differences in mental models held by decision-makers can lead to widely different interpretations of available data. Furthemore, the sources of the data may be rarely investigated and tested.

6. Environmental factors, such as uncontrollable and unanticipated changes in markets, economic, conditions, or competitor actions inevitable alter the impact of decisions. This is true especially over the long time spans relevant to organizational actions.

Isaacs and Senge call these factors Confounding factors.

As the CBLE is placed to the previous ideas this results in the cycle presented in Figure 3 (Isaacs and Senge, 1992). In this figure Isaacs and Senge use the term 'virtual world'. This figure illustrates us how a virtual world or a CBLE can turn visible the learning limits obscure in real world. Thus, CBLEs provide a rapid, unambiguous, and systemic feedback on actions taken. They provide a relatively low-risk setting in which differences in mental models can be explored and tested. CBLEs can reflect back previously tacit assumptions and can provide insights into the nature of the complex interactions that determine the consequences of managerial decisions.

FIGURE 3
THE IMPACT ON LEARNING USING VIRTUAL WORLD (ISAACS AND SENGE, 1992)



Of course, Isaacs and Senge (1992) also note some difficulties and problems in the use of CBLEs limiting the learning experience. Researchers may typically operate in a way developing views, which they advocate unilaterally and see their task as imposing their view, and seek to protect their image as experts. By doing so they are undermining the effectiveness of the learning environment that they are seeking to foster. For example, the researcher may give little freedom to participants. This will create defensiveness and lessen the ownership of participants in the overall process. Isaacs and Senge divide the users of CBLEs to protective and reflective ones (Table 1).

TABLE 1
PROTECTIVE AND REFLECTIVE USERS OF CBLES (ISAACS AND SENGE, 1992).

Protective users of CBLEs	**Reflective users of CBLEs**
CBLEs used to:	CBLEs used to:
Prove a point	Increase practical experimentation
Keep assumptions hidden	Promote inquiry into 'why's'
Validate own predispositions	Challenge predispositions
Make selective use of data	Encourage open testing and public criteria for testing
Give predetermined answers, cover-up predetermination and remain unaware of doing so	Develop internal commitment to objectivity, actively encouraging inquiry into own views
Act like an oracle	Experience the system and the assumptions in it as the cause of behavior

REPRESENTING BUSINESS PROCESSES WITH A CONTINUOUSLY PROCESSED BUSINESS GAME

There are two main types of simulation processing (Dictionary of Computer Science, 1989): continuous and discrete event. The choice between these two in any particular case is determined by the nature of the system to be simulated and the purposes that the simulation is intended to achieve.

Discrete (event) simulation refers to an abstraction, which relies on a step-by-step representation (Wyatt, 1975). In discrete event simulation it must be possible to view all significant changes to the state of the system as distinct events that occur at a specific point in time (Dictionary of Computer Science, 1989). The simulation then achieves the desired behaviour by modelling a sequence of such events, treating each individually. Continuous simulation refers to the abstraction of the real process being simulated to a set of mathematically continuous functions (Wyatt, 1975). A continuous simulation views changes as occurring gradually over a period of time and tracks the progress of these gradual changes (Dictionary of Computer Science, 1989).

Whicker and Sigelman (1991) divide simulations into two categories, too. The first one is the batch-processed model, in which all behaviour subroutines are spelled out beforehand, in the computer code. Thus, no human input is required during the simulation. Whicker and Sigelman call this method also as non-interactive model, meaning that there is no interaction during the simulation. The second one is the interactive model, in which the model's performance periodically is adjusted to account for input supplied by the modeller while the model is running. This requires the model to stop in midstream and pose a question to the modeller (Whicker and Sigelman, 1991). When the model receives the answer, it will proceed accordingly. Whicker and Sigelman describe how 'business strategy games' are processed: *Typically, the player feeds information into a computer program and receives back a series of optional or additional data that are conditional upon the player's initial choices. The game proceeds through several series of these interactive, iterative steps.*

Huckfeldt et al. (1982) note that the choice of discrete time models rather than continuous time models has important substantive implications. However, they note also that the models employed should not be judged on the extent to which they replicate a social process, but rather on **the extent to which they help us understand a social process**. We feel strongly that in order to understand a process we have to be able to witness and see it, and more precisely to be able to interact with this process. The flow of decisions and their outcomes in games and competitions is seldom predictable. Their logic may find several different paths depending on the participants and be utterly unpredictable. This is why we think that the main stream approach to business games the discrete-event or batch processing method lacks some necessary characteristics needed to describe the phenomena of business decision-making: the genuine interaction between the simulation model and the game participants in unanticipated and unpredictable points of time. In discrete event models the human behaviour of the participants is inevitably an approximation of human decision-making. This is because the game participants cannot within the simulated term - decide the exact point in time their decisions are executed. Instead, this is estimated and decided by the computer simulation.

The treatment of time in business games remains little discussed. However, we feel that the treatment of time in business games is an important aspect, for example, from the point of view of how the participants perceive the educational aspects of the training session. Thavikulwat (1996) argues that how time is treated in a computerised gaming simulation circumscribes the issues the simulation can address, the procedures that participants must follow, and the work that the administrator must do. The way time is treated may limit the issues that can be addressed and that the gaming simulation must allow a clear distinction between the short and long term. Thus, the pacing of time is critical. For example, if time moves fast, participants' decision-making depends more on gut-level attitude, less on time-consuming analysis. If time moves continuously, when participants decide can be more consequential than what they decide. Thavikulwat notes that in simulation, as in life, "time is of the essence . The management of time is an essential theme in the new business game construction described in this paper.

Thavikulwat (1996) sees four different simulation drive-design possibilities (administrator-driven, participant-driven, clock-driven, and activity-driven simulation). A clock-driven simulation advances time in concert with the computer's internal clock. Thavikulwat mentions that this design would be elegant in games that allow for interdependence among participants. Furthermore, Thavikulwat mentions one clock-driven business simulation, Chiesl's (1990) marketing simulation.

Chiesl (1990) quests for realistic business episodes into the university classrooms. He mentions that interactive computer terminals offer the possibility to construct dynamic simulations without a fixed time period or a specific number of required decisions. Chiesl calls this technique interactive gaming. Chiesl states that present (this is in 1990) business games are time fixed format games and their decisions are based on a predetermined decision interval, for instance, quarterly or monthly reports. According to Chiesl, this does not represent the working of today's dynamic business world. Chiesl asks for continuous data input and output when students want it, not when game designers allow the students to input and output at some arbitrary discrete time format. An interactive business simulation would offer the students a more realistic environment than the fixed-time format business game. Thus, participants experience a business environment that has the appearance of being true and real.

Chiesl (1990) argues that an interactive real time simulation offers a more realistic environment than standard business simulations because students are able at any time in the simulation to change their input variables without waiting until the next fixed time period. Furthermore, Chiesl argues that the students' requests are instantaneously answered although this cannot always be the case as usually the outcomes of decisions take some time to materialize. Another exception to the majority of business games is that Chiesl's interactive simulation does not require a specific set amount of decisions be input each time period. Thus, students can change one, some, all, or no variables whenever they choose.

Besides of Chiesl (1990) the only two references we have found mentioning real-time processing are Patz (1990) and Lawrence (1997). According to Patz (1990), simulations should become continuous rather than discrete processes. Decision rules should be entered at any time, and competitive results continue to occur whether or not any decision rule changes have been made. Patz notes that this will require a multitasking environment running several programs simultaneously. But why these kinds of structures have not been constructed before? Patz may give us one possible explanation: simulation purposes, for the most part, are decided by coding convenience rather than pedagogical, conceptual, or theoretical relevance.

We argue that to better describe the present business environment and processes, business games should include the influence and importance of time to be embedded in the business game. Besides of this, the new business game construction (REALGAME) described in this paper includes a holistic view of business (all major business functions and stakeholders) to be represented for the game participants. Furthermore, the construction includes the ability to configure the business game to describe different business environments.

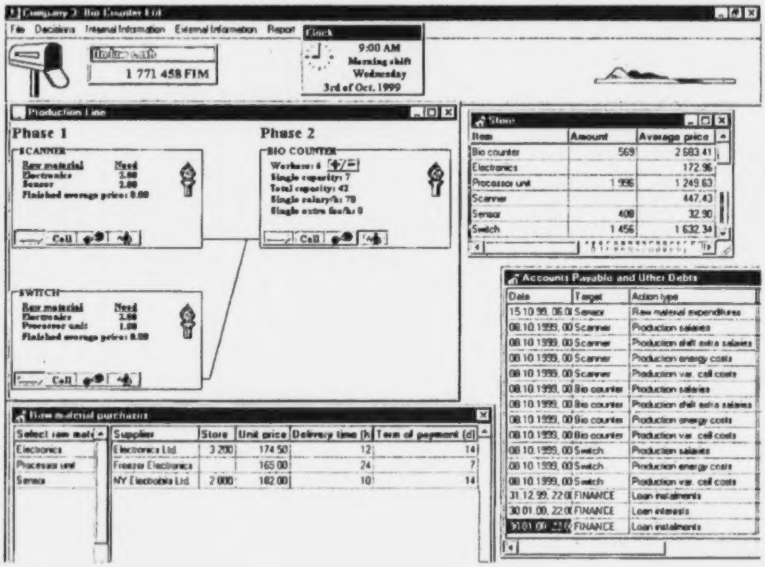
The time argument means that the connection between players, supply market, customers and capital market needs to be interactively processed. What is essential is the role of time in simulating the time-bound business processes, decision-making, and the communication between the companies and different stakeholders. What is suggested here is a real-time or on-line processed business game. Decision-making and results from the decisions made should be in an interactive on-line mode as they are in the real-world environment. In an on-line processed business game different business events and processes take place continuously and concurrently, and often in varying frequency. The participants steering the company perceive all the market events and internal processes on-line. What ever happens can be seen without a delay and action can take place instantly, if only the participants realize and need to do so. Thus, the game emulates the real world processes of business environments with the major exception that the internal simulation time is accelerated compared to the real world. In managing this kind of environment the participants' ability to perceive processes and causal dependencies is essential.

The on-line processed game (REALGAME) is developed at Turku Centre for Computer Science, and Turku School of Economics and Business Administration during 1997-1999. This new game construction has been used five times in teaching during 1999 and 2000. REALGAME is planned to describe the causal dependencies in decision-making better than the batch processed business games. Parts of the functions of REALGAME are introduced in Figure 4.

In REALGAME there are 4-12 competing companies and the markets, suppliers and funding organisations are common to all participating companies. This game has been programmed with a Rapid Application Development (RAD) tool (Delphi) in Windows environment. Delphi enables the use of databases and supports user-defined inherited objects. Both of these resources have been noticed to be inevitable for the creation of REALGAME. Databases are needed in order to record all the detailed business transactions taking place during the game run. Without the object oriented development environment it would not have been possible to create a truly configurable business game environment.

In continuous game processing the functions are executed on a continuous and iterative manner. Different steps can enact simultaneously or apart. Different iterative decision loops may occur in the same pace or in a different pace. The process is never ending and easing off the decision-making results most certainly in troubles. Furthermore, the participants are part of the game processes. This means that they see the changes in their environment to evolve on-line. We feel that this is a major difference if we compare continuous processing to batch-processing: the participants are organic part of the business processes and are able to witness and see them, and most of all - are able to continuously interact with this process.

FIGURE 4
PARTS OF THE FUNCTIONS OF THE REALGAME.



1 771 458 FIM

9:00 AM
Morning shift
Wednesday
3rd of Oct. 1999

SCANNER

Raw material	Need
Electronics	2.00
Sensor	2.00

Finished average price: 0.00

BIO COUNTER

Workers: 6
Single capacity: 7
Total capacity: 42
Single salary/h: 70
Single extra fee/h: 0

SWITCH

Raw material	Need
Electronics	2.00
Processor unit	1.00

Finished average price: 0.00

Item	Amount	Average price
Bio counter	569	2 683.41
Electronics		172.96
Processor unit	1 996	1 249.63
Scanner		447.43
Sensor	408	32.90
Switch	1 456	1 632.34

Date	Target	Action type
15.10.99, 06.0	Sensor	Raw material expenditures
08.10.1999, 00	Scanner	Production salaries
08.10.1999, 00	Scanner	Production shift extra salaries
08.10.1999, 00	Scanner	Production energy costs
08.10.1999, 00	Scanner	Production var. cell costs
08.10.1999, 00	Bio counter	Production salaries
08.10.1999, 00	Bio counter	Production shift extra salaries
08.10.1999, 00	Bio counter	Production energy costs
08.10.1999, 00	Bio counter	Production var. cell costs
08.10.1999, 00	Switch	Production salaries
08.10.1999, 00	Switch	Production energy costs
08.10.1999, 00	Switch	Production var. cell costs
31.12.99, 22.0	FINANCE	Loan instalments
30.01.00, 22.0	FINANCE	Loan interests
31.01.00, 22.0	FINANCE	Loan instalments

Select raw mate
Electronics
Processor unit
Sensor

Supplier	Store	Unit price	Delivery time (h	Term of payment (d)
Electronics Ltd	3 200	174.50	12	14
Freezer Electronics		165.00	24	7
NY Electrobits Ltd	2 000	182.00	10	14

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Actually, REALGAME does not operate in true real-time processing. True real-time processing would mean that each and every independent game object (e.g., a customer or a supplier) would have its own internal Timer object, which would activate independently of everything else in the game and process all object specific tasks and processes. Very early in the development of the game this kind of true real-time processing was tested but proved to be impossible to use. This is because of the Windows operating system, which allows only a limited number of active Timer objects to be used at a time. However, the processing is continuous in the sense that:

The game time is clock-driven, smallest increment in time being one hour.

The participants are not tied to make decisions in specified points of time but can make decisions whenever they choose during the game.

The decisions made in each point of time can be single decisions or several decisions but no decision batches are required.

The participants may choose to run reports at any point of time.

The participants see the internal and external business processes to evolve, e.g., hour by hour, depending on the game parameters (explained below).

According to de Geus (1988) one reason for putting mental models into computers is that in working with dynamic models, people discover that in complex systems cause and effect are separated in time and place. He mentions that to many people the insight to these causal phenomena is counterintuitive, thus, we are not able to find other trigger points than the most immediate causes to create the requested effects. The use of dynamic models helps us to discover other trigger points, separated in time and place from the desired effects. Another reason for the use of dynamic models, according to de Geus, is that by using computer models we learn what constitutes relevant information. For only when we start playing with these microworlds do we find out what kind of information we really need. If people are to learn about causal correlations and interdependencies, we need training tools, which can represent these causalities.

These reasons put forward by de Geus have encouraged us to experiment with REALGAME in association with teaching the unfolding of business processes. We feel that REALGAME can provide students perception about the causal both in time and structure dependencies between business activities.

CASE CORPORATE INFORMATION SYSTEMS

This paper describes one particular teaching experiment using the real-time processed business game described above and a commercial process modelling software. The experiment was carried out in Turku School of Economics and Business Administration as part of an information systems course.

Turku School of Economics and Business Administration (**TuKKK**, http://www.tukkk.fi) is the second largest business university in Finland. TuKKK is an independent university consisting of departments of Accounting & Finance, Management, Economics, Marketing and Languages. Information Systems Science (**ISS**) is part of the department of Management. The role of ISS is twofold. Firstly, the main emphasis of the teaching given to the student studying IS as their major is to offer skills needed to specialise in professional information systems positions. Secondly, ISS gives several courses to a vast amount of students studying business economics as their major. The main emphasis of this teaching is to clarify the role of information systems in organisational context and give basic skills in information technology utilization.

One of the courses with emphasis on IS tools skills and aimed at the students studying other than ISS as their major is **Corporate Information Systems (CIS)**. The aim of the course is to give the students readiness (a) to understand the importance of enterprise systems in the business operation context, (b) to be able to take advantage of enterprise systems, and (c) to resolve different business reporting needs.

In spring term 2000 145 students enrolled on the course. The course included 14 hours of lectures during a seven-week period with emphasis on the use of different computer tools commonly used in different business organisations. The themes covered on the course were:

principles of creating queries and reports with a relational database application (6 hours),

the use of a typical enterprise information system in the supply and delivery process (4 hours),

the use of a project modelling application (2 hours), and

describing business processes with a process modelling application (2 hours).

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The tool used in describing business processes was Process Guide (**PG**). PG is a commercial computer application developed by QPR Software Ltd (http://www.qprsoftware.com). PG is a tool that can be used to:

Create business process models to illustrate the current status of operations.
Monitor and measure performance in areas such as lead-time, costs and quality.
Identify bottlenecks and simulate processes to analyse alternatives, predict operational changes, validate new plans and plan resource allocation.

From the using stand of point PG is a relatively simple program. Mainly, the users need to:

know from three to six graphical flow chart symbols,
be able to create a process flow chart using these symbols,
name cases to be studied within the process chart,
attach different measures (for example, costs or lead times) to case specific tasks defined in the flow chart.

One of the aims of CIS is to give the students a holistic view of business processes and the role of corporate information systems in this holistic structure. Based on this aim the teacher of CIS (the author of this paper) decided to combine an imaginary business game case with the use of PG. The teacher as a researcher - hoped to gain knowledge on how a real-time processed business game would suit to be used as a business process case description tool. This business game case would then be modelled with PG. Both the use of the business game and creating the process model with PG were done independently by the students. The students were told to carry out the assignment either alone or in groups of two students.

The case was described, the tools represented and the assignment carried out as follows:

Both tools used (REALGAME and PG) were introduced and used in the two-hour lecture. The game configuration used was as a network game, all the students in the class competing against each other.
The assignment was introduced in the lectures and also included as a web page. The assignment included a detailed description of computer task steps to be taken in order to start the business game. Furthermore, the course pages included an eight page long guide on how to use PG.
As the students independently carried out the assignment they first initialised the business game to be used in the computer they had logged in by starting a DOS batch file.
Then the students were supposed to start the game market application and as the last step start the business game decision-making application.
After they had played the game long enough to get an understanding of how the delivery process was processed in the game, they were supposed to illustrate and document a customer specific business game delivery process as a PG case.
The students were supposed to return the PG case descriptions (the PG process flow file) to the teacher to be evaluated and given performance marks. With PG the students first created a process flow chart. For the tasks in the process flow chart the students entered case specific values to a certain process measure, the lead-time. The values for the lead-time were supposed to be taken from the processes simulated with the business game. After the values had been entered to the tasks the students were asked to browse through the different analysis tools of PG, e.g., a Gantt chart.
After all the previous steps the students were asked to return a questionnaire on how they experienced the use of the business game as a case description tool in a process modelling exercise. This questionnaire was filled out by individual students (even if the student was part of a group) and returned anonymously.

The teacher tested the use of REALGAME beforehand in the computer classes. However, the test was too short in time to reveal that the capacities of the computers in use were too low. Overa . 21 students directly stated that they had technical problems during the game. Actually, we have every reason to believe that most of the students faced technical problems. This was due to the two computer classes used in this exercise. The computers in the classes proved to be much too slow for running the business game.

RESULTS FROM THE TEACHING EXPERIMENT

The analysis of the questionnaire produced the following results. Tables 2 and 3 describe the results of the two closed questions. 71 students of the total of 131 students taking part on the exercise returned the questionnaire. 56

of the students had previously taken part to some other business game training with some other business game. Most of these had played the old game of the school, which is a typical batch-processed total enterprise business game. The students all had previous experience from case exercises carried out in ISS and other courses. We thus assumed that the students were quite familiar with the strengths and weaknesses of case exercises.

The results in Table 2 show that the students did not clearly prefer either the business game case or a text case. We find this result encouraging considering the technical difficulties the students faced during the experimentation. We also believe that the design of the experimentation was inadequate (as mentioned later in conclusions). As this was a preliminary test with the game in this kind of exercise we feel that by carefully developing the exercise it is possible to achieve better results.

The results of Table 3 affirm the interpretation we made from the results of Table 2. Table 3 shows clearly that students found potential in this kind of exercise and it is probably that the technical difficulties affected the answers of Table 2.

Below we have collected some typical answers to the two open questions of the questionnaire. Some answers to the question: **Your general comments on the use of the real-time processed business game?**

- *With games you get a proper feel of the complexity of business decision-making! The game must be played, e.g., two days at a time in order the "idea" to become clear. This was missed in this game and this is why understanding and evaluating this game is difficult.* (International marketing, 3rd year)
- *It was needless waste of time to mix the game with this exercise.* (Accounting, 3rd year)
- *Store management and production process well implemented but strategic decisions are not well enough presented.* (Accounting, 2nd year)
- *... The phases of delivery process were better represented in the game than would have been in a text case.* (Accounting, 3rd year)
- *Good from the stand of point of understanding the holistic process but the realism with the game was so and so.* (Marketing, 2nd year)
- *We should be able to play the game more in order to fully understand the process that the game was intended to describe. If the game functions better and the game would be played at the same time with other companies it would be a good teaching tool.* (Accounting, 4th year)
- *Quite good thing that one had to think more oneself when one made the process model description. I think a text case is much simpler. OK!* (International marketing, 2nd year)
- *If the game only would work all right it would be just nice alternative "teaching method". It would be a good thing if there were more response on the success of gaming as the game proceeds.* (Information systems, 2nd year)
- *Helps visualise chains of tasks and through this the functioning as a whole.* (International marketing, 2nd year)
- *The game crashes a lot but it clearly includes potential because it represents well the different business functions. It also well describes the dependencies of functions.* (Accounting, 2nd year)
- *The game did not adequately represent the successive dependencies of business tasks. All the functions were separate from each other behind menus. You have to in advance yourself piece together the order of the functions. I think that the game does not teach you anything; quite the opposite: it mixes your conceptions.* (Accounting, 4th year)
- *There certainly is potential as soon as the technique works all right and the system crashes are prevented. It is not meaningful to play the game alone with the computer. Only in group-use competing against others it is fun and interesting.* (Marketing, 2nd year)
- *There certainly is potential but the game was not best possible for this exercise. The process of the game was too lean as a case to be used in connection to PG. We would have needed a more detailed process to be represented with PG...* (Accounting and Finance, 2nd year)
- *I think the game has its role in outlining the business reality although the real world is much more complex than this kind of game...* (Accounting and Finance, 2nd year)

TABLE 2
THE RESULTS OF THE QUESTION CONCERNING THE STUDENT PREFERENCE OF GAME OR TEXT CASES

Question	Text case	Game case	No stand	Both
An alternative for the use of a business game case description could have been a text case description. Which one would you have preferred in this assignment?	N= 35 **49.3 %**	N= 34 **47.9 %**	N= 1 **1.4 %**	N= 1 **1.4 %**

TABLE 3
THE RESULTS OF THE QUESTION CONCERNING THE POTENTIAL OF BUSINESS PROCESS TEACHING

Question	Yes	No
Did the real-time processed business game include teaching potential to be used as a tool to clarify the flow of business processes?	N= 49 **72.1 %**	N= 19 **27.9 %**

The answers clearly reveal two things. First, the time spend in the exercise was quite too short. The students did not achieve required understanding of the complexity of the case company. Secondly, several students stated that the game should have been played in a competitive manner, companies fighting against each other. This certainly would have made the gaming much more interesting for the students and created enthusiasm among them. Several of the students already in their answers to this question mention that the game introduced business processes.

Following some of the answer to the question: **If you did think that the real-time game included potential to clarify business processes describe which processes can best be clarified?**

- *Best can be clarified the offer – order – delivery – invoicing chain. ... Also the competition situation is illustrative if the game can be played "a day at a time" against other companies.* (International Marketing, 3rd year)
  Sales and purchases (Marketing, 2nd year)
  Store management and the importance of time in decision-making. (Business Law, 1st year)
  The store management necessitated by the production process, and the importance of well-timed deliveries. (Accounting and Finance, 2nd year)
  The delivery process, I guess, although I was confused by the perpetual changes in time and the changing of production shifts... Besides the situations did not follow each other so that the gaming would have been easy... All gaming without any longer absorption and, for example, the product to be sold is the ultimate culmination of theorisation. It is really hard to enter into the game effectively if you do not know anything about delivery and order management times, if you have not made acquaintance yourself to the processes of the company... (International Marketing, 2nd year)
  The different phases in order – delivery process were easily to be discovered. Furthermore, the influence of purchases and funding to company operations were clearly expressed with the use of the game. I did not familiarise myself with the marketing process but the impression of it remained quite incomplete. Thus, there is potential mainly in order–delivery process, purchases, and the monetary process. (Accounting and Finance, 3rd year)
  You immediately noticed that with a more competitive offer you get more orders. The complaints of the customers about late deliveries were realistic. (Accounting and Finance, 2nd year)
  The basic processes became very clear. E.g., receiving orders and delivering, and store

management and deliveries in connection to store. (International Marketing, 2nd year)

... I think that the fast speed of the game and delivering the orders in time were challenging. On the other hand it was good that the game company functions were not taught before the playing but we were forced to ourselves realise what different functions to take care of when playing. (Information Systems, 2nd year)

Purchases, production, delivering, invoicing and funding are well represented. The real-time processing of the game increases the fascination and gives the game an intensive nature. I think the processes have been logically represented and they are diverse. This gives a good basis for the game to be used as a training tool. Also taking under consideration the different time spans of receivable and payable gives depth and realism. (Accounting and Finance, 2nd year)

Many of the previous answers reveal that the students had realized the nature of the game company's material process from raw material purchases to deliveries. Several of the answers also mention the influence of the time aspect on decision-making. Most of the answers clearly advocate the use of the game in clarifying business processes. This is probably the most important result from the experimentation encouraging us to further develop the gaming case for future ISS courses.

CONCLUSIONS

Although there is a lot of criticism in these answers we certainly see some encouraging issues. On the basis of the student opinions we are inclining to argue that a real-time processed business game has some advantages compared to text cases. A game can represent the complexity of a business much more realistically than a text case. Furthermore, a business game can reveal the dependencies between functions in a much more illustrative way than a text case. The experiment described in this paper left a lot depending upon the students to themselves get motivated and interested in the business game. The teaching experiment described in this paper faced some severe misfortune but still some positive results of the experiment can be perceived. The answers to the questionnaire were clearly twofold. Other students were definitely irritated by the technical problems they met during the experiment. The attitude of these irritated students towards the game most probably was distorted and we were not able to get objective opinions on the gaming from them.

As we were expecting that a reflective stand (Table25 September 2000 1, Isaacs and Senge, 1992) to the game exercise would increase the learning value of the experiment we were a bit disappointed. Thus, the students did not take the full advantage of the possibility to open testing and practical experimentation. However, we are inclining to believe that this was because of the limited time for the exercise and some obvious shortcomings in the exercise design. It must be ensured that the time used to the exercise is long enough for the students to really get familiar with the processes. This probably means that the exercise must be carried out like in conventional business game training so that the students are all gathered together at the same time and place to compete against each other. Securing the time needed for the exercise will also bring along the competitive situation between the participants, which will further enhance the student interest in the game.

Despite several students faced technical problems as they used the business game they did not prefer clearly either a business game case or a text case. This will encourage us to further experiment with REALGAME in similar exercises. In fact, we believe that a more thoroughly designed game case exercise will produce both better learning results and participant motivation. We strongly feel that the results achieved here speak for continuing with this kind of research. More solid evidence of the applicability of gaming will be represented in the future.

As an overall conclusion from the experiment we argue that there is educational potential in the use of simulations describing business process flows. However, the teaching session has to be carefully briefed and motivated. The exercise must be challenging enough and not to underestimate the skills of the participants. For more information about REALGAME business processes see http://www.tukkk.fi/~tlainema.

REFERENCES

Aram, Eliat, and Dorothea Noble (1999). "Educating Prospective Managers in the Complexity of Organizational Life . *Management Learning*, Vol. 30(3).

Argyris, Chris, and Donald Schön (1978). *Organizational Learning: A Theory of Action Perspective.* Addison-Wesley, Reading, MA.

Bunge, M. (1973). *Method, Model and Matter.* D. Reidel Publishing Company, Dordrecht, Holland.

Chiesl, Newell E. (1990). "Interactive Real Time Simulation . In Gentry (ed.) *Guide to Business Gaming and Experiential Learning*. ABSEL.

Dictionary of Computer Science, English-French (1989). ISO/AFNOR.

de Geus, A. P. (1988). Planning as Learning . *Harvard Business Review*, March-April, 70-74.

Huckfeldt, Robert R., C. W. Kohfeld, and Thomas W. Likens (1982). *Dynamic Modeling, An Introduction*. Sage Publications, Inc.

Isaacs, William and Peter Senge (1992). "Overcoming limits to learning in computer-based learning environments . *European Journal of Operational Research*, 59, 183-196.

Ju, Edward and Christian Wagner (1997). "Personal Computer Games: Their Structure, Principles, and Applicability for Training . *The DATA BASE for Advances in Information Systems*, Vol. 28, No. 2.

Kolb, David (1984). *Experiential Learning: Experience the Source of Learning and Development*. Prentice-Hall, Inc.

Lee, Denis M. S., Eileen M. Tráuth, and Douglas Farwell (1995). "Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation . *MIS Quarterly*, September 1995.

Naylor, Thomas H. (1979). "The Age of Corporate Planning Models . In Naylor, Thomas H. (editor): *Simulation models in Corporate Planning*, Praeger

Lawrence, P. J. (1997). "Business Simulations: dynamic, computer based case studies for management development , in *The Place of Information Technology in Management and Business Education* (edited by Barta, B., A. Tatnall and P. Juliff), Chapman & Hall.

Patz, Alan L. (1990). Open System Simulation . In Gentry (ed.) *Guide to Business Gaming and Experiential Learning*. ABSEL.

Pidd, Michael (1998). *Computer Simulation in Management Science*. Fourth Edition, John Wiley & Sons.

Thavikulwat, Precha (1996). "Activity-Driven Time in Computerized Gaming Simulations . *Simulation & Gaming*, March 1996, Vol. 27, Issue 1.

Whicker, Marcia Lynn and Lee Sigelman (1991). *Computer Simulation Applications, An Introduction*. Sage Publications.

Wyatt, Joe B. (1975). "Computer systems: Simulation . In *The Information Systems Handbook*, McFarlan, Nolan (editors). Dow Jones-Irwin, Inc.

ONLINE COURSES AND COLLABORATIVE LEARNING: UNDERLYING PHILOSOPHIES AND PRACTICES

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ABSTRACT

The purpose of this article is to draw a distinction between the use of group work and subgroup work in the delivery of online courses, and along the way to pose the question "What should be the objective of the instructor?" To do this, four different models of online course delivery used in the teaching of IT and IS courses are described. Each model is distinguished from the others by the varying levels of group work (low to high) and subgroup work (low to high) used as an essential component of the learning process, and the advantages and disadvantages of each model are discussed. The paper concludes by suggesting that the objective of the instructor may play a hidden but substantive role in the selection of the model to be used.

INTRODUCTION

An appropriate definition of collaborative learning that will suffice for our purposes is "...a learning process that emphasizes group or cooperative efforts among faculty and students. It stresses active participation and interaction on the part of both students and instructors. [Bruffee 1984], quoted by [Hiltz 1994].

Collaborative learning is hardly a new topic. The importance and relevance of social interaction to an effective learning process has been stressed by many theorists from [Vygotsky 1978], through advocates of situated learning such as [Lave and Wenger 1991], and has been confirmed by many more recent researchers and practitioners.

An up-to-date review of the research and the long history of peer/collaborative learning can be found in [McKeachie 1999]. A small but select annotated bibliography on collaborative learning can be found at [Planck et al 1999]. An excellent list of strategies and tips for those interested in introducing collaborative learning can be found in [Davis 1993].

When students and instructors are linked by computers, the groups become electronic collaborative learning groups (ECLGs). Several studies appear to show that,

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particularly for more mature students, such a learning environment can be more effective than traditional face-to-face classroom sessions. See for example [Hiltz 1994, Harasim 1995].

Other benefits of group work, or collaborative learning, have been widely described in the literature. For example, group work is seen to enhance critical thinking [Gokhale 1995], and can assist in the retention of minority students [Berry 1991].

The phrase "group work is usually used within an academic context in cases where the students are broken up into small groups; however, it is also used in cases where all of the students in the class work as a group. It is useful to distinguish between the two. This paper uses the term "group work to mean an activity where all of the students in a class can interact (and thereby assist each other), and "subgroup work to mean an activity where interaction occurs only within small distinct groups (and thus subgroups could be perceived to be competing against each other). This, the differentiation between "group and "sub-group is not at all a matter of the size of the group, but of whether the students perceive there to be competition between groups.

The phrase "online delivery is used to refer to a course which is primarily web-based, with course materials and other items being made available over the Web to students connected from remote locations.

THE INSTRUCTOR'S OBJECTIVE

When the pedagogy to be used for the online delivery of a particular course is discussed, many topics are debated, but the objective of the instructor is rarely amongst them. For it is assumed, firstly, that the instructor is there to assist the students to learn, and secondly, that since this is so obviously the case, no further consideration of the matter is warranted.

In the academic context, all of the students share a common objective to master the material sufficiently to ensure a good grade. In the "real world outside of academia, it is generally the norm that people with a common objective will work together as a team, either formally or informally. Only where there is an element of competition where the success of one might mean the failure of another is this not usually the case.

Now, it may be argued that the students do not in fact share a common objective rather, each student has the unique objective that he or she should get a good grade, rather than the whole class.

What then should be the instructor's objective? Suppose that the instructor has the choice of using two different methodologies, both of which tend to produce results in the form of bell curves with the peaks occurring in the Pass or Credit ranges; but that in one, the peak is very pronounced, with very few students achieving results in either the High Distinction or Fail ranges, whereas in the other the peak is less pronounced, with the final range of results being more widely spread. Suppose further that the difference is not a result of the marking scheme alone, but a true reflection of the students' learning. In such a case, which of the two methodologies should be preferred, and why? The current authors are not aware of any literature directly addressing this question; a paper discussing this issue in some depth is in preparation [Roberts, 2001].

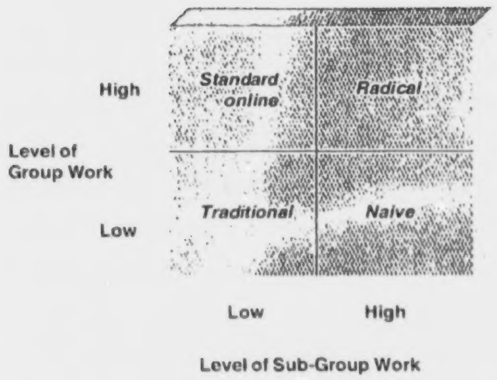
It is at least arguable that faced with such a dilemma the instructor should strive for the good of the class as a whole, rather than for the good of particular individuals. This has obvious parallels in the realm of political philosophy, where to take an admittedly simplistic generalisation the theoretical Socialist will work for the good of the population as a whole, in the belief that this is most likely to benefit the majority of individuals, whereas the theoretical Capitalist will work for the good of each individual, in the belief that this will benefit the population as a whole. In what follows, therefore, we will refer to the former as a type-S choice, and the latter as a type-C choice.

This paper looks at four models of collaborative learning that fall on either side of this political divide.

THE FOUR MODELS

The four approaches, all in current use in the delivery of online Information Systems courses at Central Queensland University, are characterized in Figure 1.

FIGURE 1



The traditional model is characterized by little or no use of subgroup or group work in the delivery of the content or the assessment of students. The radical model uses both subgroup and group work to almost the maximum possible extent. Sitting between these two, are the naïve model, which uses subgroup work but no group work, and the standard online model, which uses group work but no subgroup work.

The Traditional Model

The traditional model is used in probably 95% of classes where face-to-face teaching in the form of lectures and tutorials is the norm. This model therefore tends to be replicated almost by default when those same courses are delivered online. Group work is minimal, and students are expected to learn in a "sage on the stage -type scenario. Indeed, the translation to online delivery often results in less collaborative learning, since the ad-hoc informal groups that may have been used in tutorial sessions are now dispensed with; consequently, little or no learning takes place in a group setting. Individual students receive feedback and criticism primarily from the instructor(s). In some cases this is wholly in the form of returned items of assignment; in others, a varying amount of feedback may be given via email or other means.

There is therefore little or no opportunity for students to learn from each other, and the learning process is heavily reliant on the knowledge and teaching skills of the instructor.

Interestingly, even where the traditional method is used, students have a tendency to form their own informal study subgroups. This appears to be a more common practice in some cultures than others, being particularly predominant amongst students from countries in the Southeast Asian region, such as Singapore and Hong Kong. Often it can happen that members of such "unsanctioned subgroups end up being penalized because of the similarity of their assignment submissions. Thus, the traditional model can in fact be antagonistic to the idea of collaborative learning.

The traditional model can therefore be categorised as a type-C choice; whereas this may be as the direct result of a conscious decision by the instructor, it is at least equally as likely to be the result of a default to the currently-predominant paradigm.

The Naïve Model

The naïve model involves the use of sub-groups, but not the group as a whole. The most common form of the naïve approach is for students to be placed into small subgroups perhaps three or four students per subgroup for the purpose of working on and submitting one or more items for assessment.

Thus, the instructor can be claiming to be using group work, but again in an ad-hoc fashion. Often, the method is used primarily for reasons of expediency in a class of 100 students, for example, having to mark 25 assignment submissions is often seen to be a far preferable and less daunting task than marking 100. On the positive side, using subgroup work such as this may allow the assessment task(s) to be of a more realistic complexity than could otherwise be the case.

The naïve model allows the students to claim at subsequent employment interviews that they do indeed have experience of working in groups. And it is true that some students may have gained educationally from the experience of working in such groups. However, the lack of defined guidelines as to how the groups are to operate, and their use in the context of a single assignment submission, means that in many cases the work will have been carried out primarily by the more able student(s) in the group, and little real benefit will have been obtained.

The naïve model can be enhanced so that group work becomes an integral and more important component of the course. To do this, consideration needs to be given to the composition of the groups, the rules under which they operate, the methods to be used for assessing individual contributions, and other similar factors; see, for example, [Davis 1993, Emerson 1997, Gregory 1994, Wolf 1994].

In most cases the naïve model can also be categorised as a type-C choice; however, if more enhancements are added to increase the value of the subgroup work, the categorisation becomes less clear.

The Standard Online Model

The standard online model uses group work (but not subgroup work) almost as an accidental by-product of the technology. The inclusion of online discussion groups allows individual students to pose questions and receive feedback from all other members of the group. In this way, students are enabled to learn as much from each other as they do from the instructor. This is one of the most commonly quoted advantages of online distance education: see for example [Jones 1996a, 1996b].

Apart from online discussion lists, other forms of interaction from the group as a whole are possible. For example, provision may be made for anonymous feedback to be provided throughout the semester, thus allowing individual students to express comments without fear of retribution, and allowing the instructor(s) to glean valuable information by which to improve future offerings. Such a feedback mechanism has been described by [Svensson 1999].

The standard online model can be combined with the naïve model, so that subgroups are used for particular items, but questions can be posed by, and feedback can be gained from, all members of the group. In such cases the resulting model would be located close to the centre of the diagram in Figure 1.

Despite the opportunities for whole class interaction, in practice the standard online model remains a type-C choice, with little or no formal collaborative subgroups being used, and little or no group assessment work.

The Radical Model

Whereas both the naïve model and the standard online model use subgroup and group work to a certain extent, the radical model uses both subgroup work and group work to almost their fullest extent, both as a means of learning and as a means of assessment.

In the radical model lectures are dispensed with entirely. Instead, students are formed into subgroups, and learn by interacting amongst themselves, and using the vast amount of existing Web-based resources, with the academic staff member(s) providing guidance as and when required. A detailed description of the radical model can be found in [Romm & Taylor 2000].

Distinguishing features of the radical model include:

> a video sent out to all students prior to the commencement of semester explaining "the way the course works ;
>
> minimal traditional instruction from the academic staff; instead, students are expected to use the set text, and make extensive use of search engines and other facilities to seek out resources available on the Web;
>
> compulsory use of the course mailing list for communication;
>
> online electronic presentations prepared by the students themselves, each based on the topic for that week;
>
> the allocation of students into subgroups, each of which is responsible not only for providing an electronic presentation at some point during the semester, but also for responding critically to all other such presentations.

The online student subgroup presentations are expected to highlight the main points of that week's topic, to explain and, where necessary, defend these points, and to suggest issues for further thought that will engage the rest of the students in a critical analysis and discussion of the presentation. A one page summary, which can be in the form of a formal abstract, precedes the presentation, followed by a well-argued analysis/critique extending over two further pages (screens). Students are welcome to use additional sources and links as required.

Students are assessed not just for their subgroup presentation but also for their comments about other presentations. Each subgroup presentation is also assessed on the quality of the discussion that follows; for this reason, it is important to the students that their electronic presentations are well crafted, thought provoking, and intriguing. Typically, by the end of semester, students will have received over one hundred inputs on their work from other students in their subgroup, other subgroups, and the lecturer.

Different assessment criteria may be used for example, for the electronic presentation, clarity and structure of presentation, originality of ideas, and ability to substantiate arguments by relevant data; for other contributions, understanding the arguments that are made by other presenters, linking them to the relevant literature, and making pertinent critical comments about these arguments.

In the last week of term, students are invited to submit a recommendation in writing on the performance of other students within their subgroup. The lecturer considers the subgroup's recommendations when allocating individual marks to members of that subgroup. A student that a subgroup decides did not contribute sufficiently may as a result suffer a reduction in mark.

The students' final marks are based on a combination of their subgroup work throughout the semester, and their performance in a closed-book end-of-semester examination.

Amongst many real advantages of the radical model may be listed the emphasis on subgroup-work, the need to use real-world skills both for effective communication and research, and the significantly lower demands on staff time than with most other models. However, students need to adapt early to the demands of the model (the first presentations are made as early as week three or four of the semester), and the model is perhaps more appropriate for postgraduate and later-year undergraduate students rather than recent school-leavers.

The radical model is the only one of the four models described here which falls clearly within a type-S categorisation. However, although this is undoubtedly true within the learning context, the assessment can be skewed toward either type-C or type-S categorisation depending upon the weight afforded to the final (individual) examination.

CONCLUSIONS

Four different models of online course delivery have been described which vary according to the extent to which two forms of collaborative learning, group work and subgroup work, are employed as both learning and assessment tools.

The radical model uses both group work and subgroup work to a significant extent. However, even in cases where the radical model is employed, it is usual to have an individual end-of-semester examination as a significant component of assessment.

It is instructive to conclude by returning to the question raised at the beginning, the objective of the instructor. In the traditional model, each student is expected to learn largely on their own; this is likely to be hardest for the least able students, and easiest for the most able. The traditional method therefore can be expected to produce a significantly wide range of results. Therefore, if the instructor is of the view that a wide range of results is preferable to a narrow range, the traditional model is likely to be favoured.

As a greater amount of collaborative learning is included, as with the naïve and standard online models, so are the least able students able to benefit more readily from the increased interaction with their peers. Thus, the range of results is narrowed slightly, while it seems probable that the mean has remained the same, or perhaps increased slightly. The naïve model is likely to be chosen by the instructor not because of this, but more likely because of the belief that it is beneficial to expose the students to some form of collaborative learning.

The standard online model is most likely to be selected primarily because of the capabilities of the existing technology, rather than for any theoretical pedagogical reasons.

When the extent of group work and subgroup work is increased to a very high level, as with the radical model, it is to be expected that the range of results will tend to diminish, while the overall pass rate will tend to increase. This model (or something like it) is likely to be chosen by instructors seeking the maximum amount of interaction amongst their students, and is the only one of the four models to fall clearly within a type-S categorisation.

Thus, it can be seen that in practice the choice of the model to be used for a particular course is not only dependent upon strictly pedagogical issues. It is likely also to be determined to a significant extent by the prior attitude of the instructor toward collaborative learning, and in particular whether he or she believes that a wide range or a narrow range of results is preferable. Thus, in the mind of the instructor, the type-C or type-S distinction plays an important (but often unconscious) role.

REFERENCES

Berry, Lemuel, Jr. (1991). *Collaborative Learning: A Program for Improving the Retention of Minority Students*. ERIC#: ED384323 HE028436

Bruffee, K.A. (1984), "Background and History to Collaborative Learning in American Colleges. *College English 46* (7), 635-652.

Davis, B.G. (1993), "Collaborative Learning Group Work and Study Teams, *Tools for Teaching*, Chapter 18, 147-158, Jossey-Bass, San Francisco.

Gokhale, A.A. (1995), "Collaborative Learning Enhances Critical Thinking, *Journal of Technological Education 7* (1), 22-30,

Gregory R., and Thorley, L. eds. (1994), *Using Group-Based Learning in Higher Education*, Stylus Publishing, London.

Harasim, L. et al (1995), *Learning Networks : A Field Guide to Teaching and Learning Online*, MIT Press.

Hiltz, S.R. (1994), *The Virtual Classroom: Learning Without Limits Via Computer Networks*, Norwood, NJ: Ablex Publishing Corporation.

Jones D (1996a), "Solving Some Problems of University Education: A Case Study, in Debreceny R & Ellis A (eds), *Proceedings of AusWeb'96*, pp243-252, Lismore, NSW.

Jones D (1996b), "Computing by Distance Education: Problems and Solutions, *Proceedings of the First Integrating Technology into Computer Science Education Conference*, pp 139-146, Association for Computing Machinery, Barcelona, Spain.

Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*, Cambridge, U.K.: Cambridge University Press.

McKeachie, W.J., (1999) "Peer Learning, Collaborative Learning, Cooperative Learning, in *Teaching Tips: Strategies, Research, and Theory for College and University Teachers, 10th ed.*, 158-166. Boston: Houghton Mifflin.

Planck, K.M., Enerson, D.M., and Neill Johnson, R. (1999), "Collaborative Learning: A Selected and Annotated Bibliography, available on the World Wide Web at http://www.psu.edu/celt/clbib.html

Roberts, T (2001), *Introducing the Capitalist and Socialist Paradigms*, in preparation.

Romm C T and Taylor W (2000), *Thinking Creatively About On-line Education*, IRMA, Anchorage, Alaska (forthcoming).

Svensson L, Andersson R, Gadd M, and Johnson A, (1999), "Course-Barometer: Compensating for the Loss of Informal Feedback in Distance Education, in Collis B & Oliver R (eds), *Proceedings of EdMedia '99*, pp1612-1613, Seattle, Washington

Vygotsky, L.S. (1978) *Mind in Society: The Development of Higher Psychological Processes*, Cambridge, MA: Harvard University Press

Wolf, T. et al (1994), "Collaborative Role-Play and Negotiation: A Cross-disciplinary Endeavour, *Journal of Advanced Composition 14*, 149-166.

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TEACHING FOR LEARNING IN IS EDUCATION: ASSESSING THE EFFECTIVENESS OF SMALL GROUP PROBLEM-SOLVING/ DISCUSSION EVENTS IN LARGE CLASS TEACHING

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ABSTRACT

This paper considers how active learning events in the form of problem-solving/discussion events can be combined with the traditional lecture to better support good teaching and student learning in IS education. A single case study is used to illustrate and evaluate the effectiveness of small group problem-solving and discussion in large classes, for student learning. The results are presented and implications for effective teaching are discussed.

INTRODUCTION

Much of university education is based on the theory that students will learn if information is transmitted during lectures or if they do things in practicals or seminars (Ramsden, 1992). Although these are not necessarily inaccurate conceptions of teaching, they represent narrow visions of teaching. By contrast, good teaching is viewed as a process of working cooperatively with students to change their current understanding (ie. change the way in which students see and use the knowledge they have); it allows students to actively engage with subject content in a way that is likely to enhance understanding. Ramsden further suggests that enhanced understanding is most likely to occur if teaching methods encourage student activity, problem solving and cooperative learning. Students are then more likely to engage with the material at higher cognitive levels including detailed analysis and understanding.

For teaching to be successful, it is important that teaching conceptions and practice be congruous with the goals of education. In higher education goals are articulated as concept use, deep knowledge and understanding, and application (Ramsden, 1992); in IS education these goals include *concept/use* (comprehension and ability to use knowledge when asked) and *detailed understanding and application* (selection of the right thing and using it without hints) (Davis et al., 1997). The IS'97 Curriculum report further identifies teaching methods such as laboratory work and project participation and presentations involving explanation, demonstration and criticism as congruous with the goals of IS education. Nevertheless, IS education like higher education, is criticised for failing to produce graduates who have achieved the goals and objectives of IS education. The concern then arises *whether IS education is providing the right type of education for the future IS professional.* A goal of IS education is to produce graduates who are equipped to function in an entry-level position in the organisation and who have the basis for continued career growth (Davis et al., 1997). Hence, Lee et al (1995) argue that the IS curriculum must be driven by a clear vision of the career path for graduates. This implies that IS graduates must not only have the skills, knowledge and understanding appropriate to their specialisation, but must also be life-long learners, able to question, to think critically and independently and to learn. If students are to develop these abilities (e.g., to think critically, and reason logically, creatively and flexibly in a variety of new situations) then educators need to examine both how and what they teach (Chalmers & Fuller, 1996).

Studies in IS education have tended to focus on the development of curriculum that meets the needs of industry (e.g., Davis et al., 1997; Gupta & Wachter, 1998) and defining an appropriate balance between technical expertise and business knowledge (e.g., Lee et al., 1995). While educators have recommended useful strategies for IS teaching (e.g., Davis et al., 1997), few have evaluated the effectiveness of these strategies in the context of IS teaching and student learning. Although there are many factors that impact teaching and learning (e.g., context, personal factors, prior knowledge), this study emphasises teaching that encourages active engagement in the large class lecture setting. This study is expected to enhance current understanding of how the lecture setting can be augmented to better support the goals of higher education (and in particular, IS teaching), by evaluating the effectiveness of small group problem-solving/discussion events in the large class setting. Such study is particularly relevant since the lecture setting, despite criticisms, remains a dominant form of face-to-face teaching in higher education.

ACTIVE LEARNING AND THE CONTEXT OF TEACHING IN HIGHER EDUCATION

Higher education utilises the lecture as the main context for university teaching in large classes. While research has determined lectures to be most effective for coverage and transmitting information, (e.g., Bligh, 1998), the lecture is strongly criticised for its inability to readily support the goals of higher education, that is, understanding and the application and evaluation of ideas (Jenkins, 1994). However, where active learning techniques are used, the lecture can be made more effective in terms of retention, transference to new situations, problem solving, and critical thinking (Horgan, 1999). Indeed, Biggs (1991) argues that the more ways in which a student engages in task-related activities, the stronger the learning. While the lecture context traditionally implies teaching as transmission, teaching for learning can be augmented by using mechanisms that actively engage students in the learning process.

Active learning is based on the assumption that learning is by nature an active undertaking, and that different people learn in different ways (Meyers & Jones, 1993); it presumes that students learn best by doing. Active learning provides opportunities for students to talk and listen, read, write and reflect on course content through problem-solving exercises, small group discussions, simulations, case studies and other activities. Biggs (1999) also suggests that active engagement in the learning process encourages the less academic student to employ high-level engagement techniques such as theorization, reflection, applyication, which are more naturally adopted by the more academic student even if the teaching method is more passive.

The following case study illustrates how the passive, less rigid, transmission-oriented environment of the lecture can be modified to encourage more active dialogue between student and teacher (Horgan, 1999) and improve the effectiveness of large class teaching. Providing opportunities for active learning while relevant in many teaching contexts, is particularly relevant in the context of IS education, encouraging students to develop the skills, knowledge and understanding appropriate to their specialisation, and become life-long learners who are able to question, to think critically and independently and to learn.

THE CASE STUDY: USING SMALL GROUP PROBLEM-SOLVING/DISCUSSION EVENTS TO AUGMENT LARGE CLASS TEACHING

Information Systems (IS) Development is a Level 2 undergraduate course. This course focuses on the analysis, design and implementation of business information systems and aims to provide students with a "good start in understanding the development and use of information in organisations through information systems and technology (IST)". IS Development is a practical, team-based activity. Successful IS development requires appropriate subject and business knowledge as well as an active engagement with subject and context, and critical thinking that leads to the creation (or modification) of information systems. IS development, as undertaken by the professional (ie. systems analyst), involves analytical, managerial, technical and interpersonal skills. Helping students to develop the softer skills of IS development (ie. managerial, analytical and interpersonal) is an essential goal of teaching in this subject.

The lecture defines the main context of face-to-face teaching in this course accounting for two-thirds of the direct teacher-student contact time.[1] Although the lecture is useful for presenting and explaining the theoretical framework and guidelines for IS development, for teaching to be effective, students must also engage in learning experiences that enable them to apply concept knowledge and develop the 'softer' skills of problem-solving, systems thinking, communication, and working with others. Such experiences are not easily furthered by the lecture approach as a teaching strategy. It is therefore important that opportunities be created that support active engagement in critical and creative thinking within context and about the business problem being addressed.

In this teaching context the lecture/discussion approach is used create opportunities for student engagement and to enhance the effectiveness of large class teaching. Here the lecturer directs attention to and explains some essential information (ie. teaching as transmission) - this is followed by questions or problem-solving exercises for students to work through individually, in small groups, or as a whole group. Problem-solving is an essential feature of the lecture/discussion approach as used in *IS Development*, and is an important aspect of teaching and of learning (Laurillard, 1997). The problem-solving exercises helps to vary the lecture and renew student attention while engaging "students in thinking about the subject matter in ways that are designed to improve their understanding of it" (Laurillard, 1997). Problem-solving requires students to apply knowledge and principles to new situations as well as test and reinforce their understanding of what they have learned (ie. at the higher level of critical thinking and analysis). Although the lecture/discussion approach is not new, its effectiveness can only be determined by an empirical evaluation within the teaching context.

To ensure that students do not feel overwhelmed in the large class setting, small groups of four persons (also called *buzz groups* or *informal cooperative learning groups*) work together to master the material presented in the lecture and apply concepts (Johnson & Johnson 1994). It is in this context that students share ideas, listen to each other, and critique and reflect on their responses. Approximately 3-5 minutes are allocated for working through the problem. Initial contributions are taken from 2-3 groups selected by the lecturer or by colleagues. After the initial contributions, groups joining the discussion are especially urged to comment on previous responses or propose alternatives. At the end of the discussion, the lecturer summarises the main points, clarifies outstanding misconceptions, and proposes significant alternatives not previously mentioned. Three or more such sessions may be incorporated into the 110-minute lecture session.

EVALUATING TEACHING EFFECTIVENESS: DATA ANALYSIS AND RESULTS

A self-administered survey questionnaire was used to collect data on the effectiveness of the problem-solving/discussion events used in lecture sessions. Of the 120 forms distributed (and 106 forms returned), 102 (85%) were determined useable. The respondents included Computer Science (CS) majors and IS majors (33%), and business-related majors with some IS (67%). While 79% of the class had taken foundation studies in IS, the remaining students (21%) had taken CS-courses only. Of the respondents 64% were male and 36%, female; 69% were European/New Zealanders, 19% were Asian and the remaining 12% were distributed among Pacific Islanders, Africans and other ethnicities. Eighty-five percent of the respondents expected a B-grade or higher.

The following measures were used to assess the study variables:

- *Student perception of teaching effectiveness* was measured on a 5-point scale ranging from "Very Ineffective" to "Very Effective". Respondents indicated the extent to which the lecture and small group problem-solving/ discussion events were seen as effective for their learning.

- *Ranking of Teaching Strategies*. Respondents were asked to identify and rank the teaching strategies they found most effective for their learning.[2] A brief comment on why this was perceived to be so was also given.

- *Motivation to learn*. Respondents indicated, on a 5-point scale ranging from "No, not at all" to "Yes, definitely", the extent to which they felt motivated to learn in this course.

The results showed that the traditional lecture was the preferred teaching strategy for 65% of the respondents, while small group problem-solving were preferred by 31.5% of the participants. Seventy-one percent rated the lecture as very effective for their learning; 55% rated small groups as very effective.

The data analyses were carried out using SPSS 9.0. A One-way MANOVA test was used to test for significant differences between responses. A median test and a Kruskal-Wallis test were used to test the following associations between student perceptions of the effectiveness of a teaching strategy and expected grade and motivation to learn.

H1a: There is an association between the lecture and motivation to learn.

H1b: There is an association between the lecture and expected grade.

H2a: There is an association between small group problem-solving and motivation to learn.

H2b: There is an association between small group problem-solving and expected grade.

The results of a One-Way MANOVA test provided evidence of significant differences in student responses (F = 5.607; p = 0.02), suggesting that students were distinguishing between the teaching strategies. The median test provided strong support for accepting Hypotheses H1a and H2a: there is an association between motivation to learn and small group problem-solving (χ^2 = 20.742, $p \leq 0.001$) and lectures (χ^2 = 16.102, $p \leq 0.01$). The Kruskal-Wallis test provided further support for accepting Hypothesis H1a, suggesting an association between small group problem-solving exercises and motivation to learn (χ^2 = 14.609, $p \leq 0.05$). Some support was also provided for Hypothesis H2b: there is an association between small group problem-solving and expected grade (c^2=8.149, p£0.05). Hypothesis 1b was not supported.

Respondents were also asked to comment on the teaching strategies which they perceived to be most effective for their learning. There were 40 comments on the effectiveness of the lecture and 19 comments on small group problem-solving. Student comments provided some support for including small group problem-solving in lectures. Participants indicated that small group problem-solving "*gets people thinking*", provided opportunities "*to apply what we are learning*", "*encourages thought and [is] good for getting different viewpoint*", exposed students to "*real life examples*", "*made you think about what had just been discussed*", and "*made understanding the ideas a lot easier by seeing it practicallyapplied*". Students also commented on "*collective knowledge*" and that "*people can share each other's ideas [and] get improvement at the same time*", and have an opportunity to "*see different viewpoints on the same problem*" (cooperative learning). One respondent also commented that this "*relieves the boredom of lectures*".

Consistent with expectations, lectures were preferred for coverage and explanation ("*Covered a lot of ground and explained important points in detail*"), clarification (e.g., "*Some aspects explained further than outlined in text*", "*Makes it more clear - with people explaining rather than reading it myself*"), providing direction for learning ("*Know where you are going*"), and stimulating interest (*Informative and interesting as well as stimulating*").

DISCUSSION AND IMPLICATIONS

The results of this study suggested that problem-solving in small groups with follow-up discussion was particularly effective for providing opportunities for students to think, to question, to listen and reflect, to apply concepts, and to learn cooperatively from each other. Although the lecture and lecture setting have limitations, the study did not suggest that active learning displace the lecture but rather that active learning techniques be used to overcome the limits of the lecture and enhance the effectiveness of large class teaching. Indeed the results suggested that students were distinguishing between the teaching strategies, and that the perceived impacts were both different and complementary. The small group problem-solving/ discussion events in particular, were associated with expected grade and motivation to learn.

In addition to promoting active learning in lectures, the problem-solving/discussion events provide an invaluable opportunity for the lecturer to reinforce main points, to find out more about the quality of student learning and to provide feedback. If students demonstrated a lack of understanding during discussions, this was clarified to help the group (and the class) understand, reflect on, and correct their responses. It was also important that groups felt assured enough to take on the problem-solving tasks without the fear of failure, and that they were willing to participate, take risks, and test and share the ideas of the group (Davis 1993; Ramsden, 1992).

Despite limitations (e.g., context, instrumentation) this case study provides some evidence to suggest that active learning supports higher level teaching conceptions and goals and can be used to effectively enhance IS teaching in the large class setting. Further study is needed to assess the contribution of problem-solving/small group discussion and other active learning techniques to student learning and learning outcomes.

END NOTES

1. Tutorials, laboratory sessions and project work are also a part of the teaching/learning context in this course.

2. Teaching in this course utilised a variety of teaching methods which include the project methods, lab exercises, and tutorials. For the purposes of this study only those rankings and comments related to the lecture strategy and the small group discussions are reported.

REFERENCES

Biggs, J. (1991). *Teaching for Learning: The View from Cognitive Psychology.* The Australian Council for Educational Research: Victoria.

Biggs, J. (1999). *Teaching for Quality Learning at University: What the Student Does.* Society for Research into Higher Education (SRHE) and Open University Press: Buckingham.

Bligh, D. A. (1998). *What's the Use of Lectures?* Exeter:London.

Brown, G. & Atkins, M. (1988) *Effective Teaching in Higher Education*, Methuen,.

Chalmers D. & Fuller R. (1996) *Teaching for Learning at University: Theory and Practice*, Kogan Page: London.

Davis, G. B., Gorgone, J. T., Couger, J. D. Feinstein, D. L. & Longenecker, H. E. (Eds) (1997) IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, *Data Base*.

Gupta J.N.D., & Watcher, R.M. (1998). A Capstone Course in the Information Systems Curriculum, *International Journal of Information Management, 18*, 427-441.

Horgan, J. (1999). Lecturing for Learning. In Fry, H. Ketteridge, S. and Marshall, S (eds), *A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice*, Kogan Page: London, 83-107.

Jenkins, A. (1994) "Active Learning in Structured Lectures" in G. Gibbs and A. Jenkins (eds.) *Teaching Large Classes in Higher Education*, Kogan Page:London.

Laurillard, D. (1997). Styles and Approaches in Problem-solving. In *The Experience of Learning*, Marton, F., Hounsell, D, and Entwistle, N (Eds), 2nd Edition Scottish Academic Press: Edinburgh

Lee, D. M. S., Trauth, E. M., & Farwell, D. (1995). Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly, 19*, 313-340.

Meyers C. & Jones, T. B (1993). *Promoting Active Learning: Strategies for the College Classroom*, Josse Bass: San Francisco

Ramsden, Paul (1992). *Learning to Teach in Higher Education*, Routledge:London

Trauth, E. M., Farwell, D. & Lee, D (1993). The IS Expectation Gap: Industry Expectations Versus Academic Preparation. *MIS Quarterly, 7*, 293-307.

TOWARDS A RESEARCH MODEL FOR DISTANCE EDUCATION – CONTRIBUTIONS FROM THE TELECOMMUTING LITERATURE

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ABSTRACT

This paper draws on an extensive review of literature associated with telecommuting and looks at features that might affect the offering and take-up of distance education, particularly distance education involving computer applications, telecommunications and web-based, off-campus delivery of courses or components of courses. The issue is discussed from the perspective of the individual, the organisation (the educational institution) and the wider community. The aim of the paper is to put forward a possible research model for the evaluation of distance education.

INTRODUCTION

The paper begins with a review of the benefits, costs and risks associated with telecommuting (Gray et al., 1993; Turban and Wang, 1995; Ford and McLaughlin, 1995; Ellis and Webster, 1997) and suggests that several of the matters here have direct relevance to the distance education decision. This theme is continued by an examination of the enablers, drives and constraints (Mokhtarian and Salomon, 1994; Tung and Turban, 1996) which provides some insight into the factors that are likely to influence the acceptance of this form of education.

Parallels are drawn between educational and work-place tasks the understanding of prescribed material, assignments, experiences and acquisition of knowledge on one hand and the components of a job on the other. Using a theoretical task model to encompass the component, co-ordinative and dynamic themes of complexity (Wood, 1986), the task characteristics of uncertainty and equivocality (Daft and Macintosh, 1981) and the organisational issues of resources and scheduling of work (Thompson, 1967), a set of attributes for educational tasks is developed. It is proposed that this model form a central component of a research model for the evaluation of the suitability of educational tasks to distance education.

In respect of the personal attributes of the individual, there are parallels with the telecommuting literature too. These are most likely to be in the areas of personal characteristics such as the ability to get information required, knowing when advice is needed, the ability to solve one's own problems and good self-management (Venkatesh and Vitalari, 1992; Gray et al., 1993; Wheeler and Zackin, 1994; Mokhtarian and Salomon, 1996a) and the home environment (Yap and Tng, 1990; Mannering and Mokhtarian, 1995).

To some extent the role of the academic is analogous with that of the supervisor. As the supervisor controls allocation, timing and resources for tasks (Starr, 1971), the academic controls task content, timing and the required resources. Accordingly, this literature, as it relates to telecommuting, offers some assistance in studies of distance education.

Telecommuting literature also provides some pointers to demographic influences on the preference to telecommute age, gender, time in the work-place, job type, education, transport, presence of small children and the number of cars in the household (Mokhtarian and Salomon, 1997; Belanger, 1999; Dick and Duncanson, 1999) some of these seem to have relevance to the decision to engage in distance education.

ADVANTAGES AND DISADVANTAGES

For the Individual

The telecommuting literature (Olson, 1983; Rice, 1987; Ford and Butts, 1991; Gray et al., 1993; Mokhtarian and Salomon, 1994; McQuarrie, 1994; Turban and Wang, 1995) suggests the following as potential advantages and disadvantages of telecommuting each item is discussed with a view to its applicability to the student undertaking distance education, using some form of information and communications technology to aid him in the associated tasks. First, the advantages...

Reasons associated with travel to work such as reduction in commuting stress, saving money and time and helping the environment some relevance to distance education; not having to attend on a regular basis may reduce travel costs for the student, particularly if long distance travel is involved. In this context it should be noted that reduction of living costs maybe a significant factor for the potential student. Also, this area might be broadened to include those for whom travel would be impossible, such as those living abroad or in remote areas.

Better able to manage one's own affairs eg. more independence, flexibility, control of the physical working environment, to study or pursue personal interests particular relevance perhaps to the post-graduate student in the sense of better managing work commitments.

To be able to work if sick, disabled or look after a sick child or other dependent potentially increases the possibility of education for those who may be disabled or extensively involved in the care of dependent children or other relatives.

To reduce the stress experienced in the office relevant perhaps to those who might find the campus environment threatening or intimidating.

To spend more time with one's family covered above.

To get more work done campus life offers many distractions for the student; while mostly seen as an advantage, some students may benefit from the possibility of removing themselves from these distractions.

...and the disadvantages.

More difficult to work at home due to less help available, motivational problems, increased family conflict and distractions one might expect these to be serious impediments to distance education for many people, requiring particular personal attributes for them to be overcome.

Viewed negatively by management, being "out of sight and out of mind if we interpret "management to mean academic staff, there could well be a feeling among distance students that those with physical access to the academic staff get enhanced help and assistance.

Exploitation by management missing out on overtime or having to work extra time to cover peak periods "management in this sense could be interpreted as the university administration which supplies resources and occasional casual work to supplement student incomes.

Travel time can be used productively, to run errands, or provides a break between home and the office travel is seen as a time for completing assignments, reading, study, etc.

The office is nicer/better equipped than a home office would be a significant issue for potential distance students may be the need to equip a home study area with a PC and appropriate software, telephone line, communications software.

The social interaction found at the conventional workplace missing out on the extra-curricular activities that take place on campus could be viewed by many as a serious impediment to distance education.

The professional interaction found at the conventional workplace getting to know one's fellow students, easy access (formal and informal) to academic staff. At a more strategic level, a diminished educational experience may result.

For the Organisation

Advantages to the organisation from telecommuting normally centre around productivity, better use of an employee's time, a wider pool of recruits on which to draw, saving on conventional office space and an extension of working hours (Katz, 1987; DuBrin, 1991; Gray et al., 1993; Hamblen, 1999). Similar advantages could accrue to universities offering distance education increasing staff work loads and the ability to offer courses outside conventional hours may appeal to university administrations; the wider pool of students is already seen as a major driving force and there could be savings in lecture halls, tutorial rooms, laboratories and other on-campus facilities.

Disadvantages from telecommuting are to do with changing the way organisations work and function, duplicating equipment costs, absence of key personnel from the conventional workplace, morale problems and security (Ford and Butts, 1991; Filipczak, 1992; Li and Gillespie, 1994; Tamrat et al., 1996; Orlikowski, 1996; Dick and Duncanson, 1999). Re-skilling academic staff and changes to more traditional ways of teaching may present problems, there will be additional costs in supporting students' online access and the absence of students from the conventional classroom may diminish the research and teaching standing of the university.

For the Community

Potential reduction in the demand for transport infrastructure, reduction in pollution and benefits to local or rural communities are often cited as possible effects of telecommuting (Blanc, 1988; Mokhtarian et al., 1995; Nilles, 1996). There is some scope for these benefits from distance education, perhaps the most significant may be the reduction in the subsidies required for public transport. Against this, business activity in the city centres and university towns may fall, travel may increase in outlying areas and energy consumption in the home may rise (Gray et al., 1993).

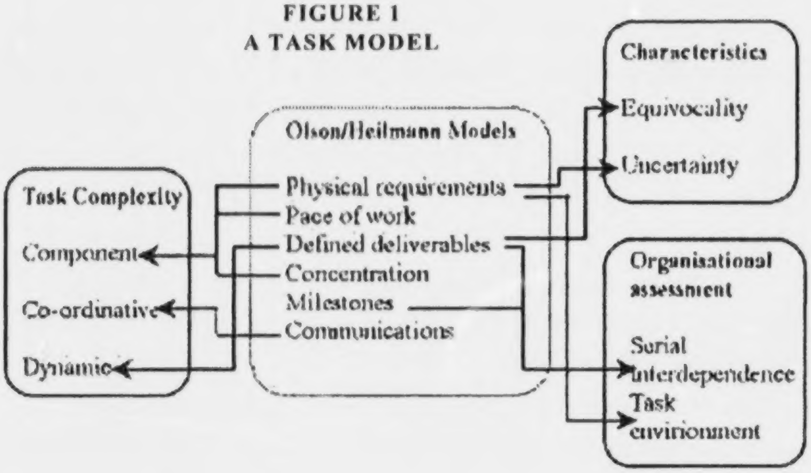
ENABLERS

There is a long list of electronic enablers which facilitate telecommuting PCs and laptops, printers, modems, copiers, fax machines, cellular telephones, answering machines, high speed communications links and access to e-mail and the Internet (Hotch, 1993; Tung and Turban, 1996). While clearly not all are required for all tasks, this list is a useful starting point for the types of electronic assistance that would facilitate distance education. At present much of this equipment is made available free of charge to students in the traditional campus environment considerable expense would be incurred by the student in equipping himself with such technology. On the other hand many universities are moving to requiring (or expecting) students to have such technology available at home.

TASK SUITABILITY

The following model, constructed from the telecommuting and task literature, outlines various aspects of task properties that make task suitable for telecommuting.

FIGURE 1
A TASK MODEL



Based on original models of task suitability for telecommuting (Olson, 1983; Huws et al., 1990) the model suggests support for these properties from the task related literature.

The original telecommuting models suggested that tasks may lend themselves to telecommuting if physical requirements (for resources and equipment) are kept to a minimum, the staff member is in a position to control the pace of his work, the work has defined deliverables, required concentration, has specific milestones set and has minimal need for communications with one's supervisor or fellow employees. There are obvious parallels here to those tasks which are likely to be part of distance education assignment writing, research, understanding course notes and lecture material and examination preparation.

In terms of task complexity (Wood, 1986), in general terms as the degree of complexity rises, the task becomes less suitable (or more difficult) for telecommuting. The same may be said of distance education. Component complexity is a function of the number of distinct acts that are required to perform the task and the number of information cues to be processed in performing these acts. Component complexity is also affected by the task being dependent on completion of other tasks. The type of task may have relevance here too some concepts may be difficult to explain or demonstrate without "hands on experience for example dissection, modelling and instrument operation. Co-ordinative complexity refers to the form and strength of relationships and the sequence of inputs. Wood suggests that the more complex the timing, frequency, intensity and location requirements, the greater the knowledge and skill the individual must have to be able to perform the task. Changes in the acts and information required or in the relationships between inputs and products Wood calls dynamic complexity. This too can create shifts in the knowledge or skills required.

To illustrate, if we consider component complexity, tasks with minimal component complexity may be those such as reading a study guide, notes or a text book and answering a series of "review questions. At the other end of the scale, research using multiple resources, including hard copy and electronic journals, text books and the Internet, discussions with a colleague and writing up a summary of the research may present difficulties for the distance education student. Likewise co-ordinative complexity could range from one person completing an assignment to working as part of a team, with each member responsible for various components and then the team having to link them together to produce a final product.

The task characteristics (Daft and Macintosh, 1981; Daft et al., 1987) of equivocality (ambiguous meanings or instructions) and uncertainty (about what is required or how to go about it) are relevant to tasks involved in distance education too considerable difficulty might be expected to be experienced by the student if tasks are not clearly explained with no ambiguity and specified to reduce uncertainty.

Similarly, the environment in which the tasks take place (Thompson, 1967) may have some relevance to their suitability serial dependence refers to the need to wait on others (academic or student) in order to commence or complete one's own work . Also relevant is the degree of "networking and team building that educational tasks are designed to include.

PERSONAL ATTRIBUTES

Successful telecommuters display certain traits (Gray et al., 1993). According to the authors, these traits are:

> the ability to make sound decisions, know where to get the information that leads to that decision making process or completion of the task and know when they need advice;
>
> the ability to solve their own problems this might require a knowledge of the organisation, the tasks or the technology and an analytical approach to problem solving; and
>
> good self management self motivation, time management, the ability to assess their own work and to be able to put these skills together to deliver quality work on time.

There is considerable support for these traits in the literature see also (Venkatesh and Vitalari, 1986; Mokhtarian and Salomon, 1996b; Lewis, 1998). Confidence in working within the electronic community (Venkatesh and Vitalari, 1986; Hesse and Grantham, 1991; Trevino and Webster, 1992) may also be an important attribute the telecommuter is isolated from "help , and runs the risk of being seen as incapable of working with the required tools, or being seen as incompetent if he/she does not hold the necessary skills.

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Other aspects identified in various studies by Mokhtarian and others include the need for self discipline, household interaction problems and aversion to risk (Mokhtarian and Salomon, 1994), susceptibility and aversion to stress (Mokhtarian and Salomon, 1997), (see also (Trent et al., 1994)) and the desire to get more work done (Mokhtarian et al., 1994).

For the distance student, knowing where to get relevant information and when to seek advice would seem to have particular importance, as does the ability to solve his own problems the added reliance on information technology and communications equipment gives this aspect added weight. Under-graduates are more likely (perhaps than there post-graduate counterparts) to have motivational problems and will need to develop time management skills to enable work of an appropriate quality to be delivered on time. On the subject of the household environment, the telecommuting issues (Mannering and Mokhtarian, 1995) of presence of small children, number of people in the household and family orientation may also have some effect on the preference to study at a distance.

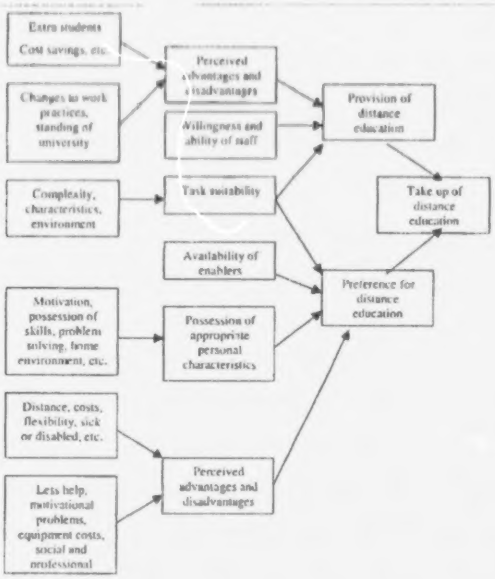
THE SUPERVISOR

The supervisor has a enigmatic role in telecommuting on one hand, without the supervisor's approval of individual instances, telecommuting is unlikely to take place while on the other, the attitude of the supervisor does not seem to affect the preference to telecommute (Dick, 2000). Nevertheless, if we align the role of the supervisor with that of the academic, some issues do arise. It has already been noted that one of the disadvantages of telecommuting to the organisation relates to changes to the way of working. Academic staff will need to learn new skills, particularly IT related ones. They will need to be prepared to "formalise presentations and the learning experience imparted to a considerable degree and to correspond with students by the, perhaps unfamiliar media of e-mail, "chat rooms and "bulletin boards. These changes will not be easy and are likely to involve universities in considerable upheaval.

A RESEARCH MODEL

The above suggests that the following model may be useful in the evaluation of distance education as an alternative for students and universities.

FIGURE 2
A RESEARCH MODEL


Extra students
Cost savings, etc.
Changes to work practices, standing of university
Complexity, characteristics, environment
Motivation, possession of skills, problem solving, home environment, etc.
Distance, costs, flexibility, sick or disabled, etc.
Less help, motivational problems, equipment costs, social and professional
Perceived advantages and disadvantages
Willingness and ability of staff
Task suitability
Availability of enablers
Possession of appropriate personal characteristics
Perceived advantages and disadvantages
Provision of distance education
Preference for distance education
Take up of distance education

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CONCLUSION

Many education institutions are considering, or have already implemented, distance education programmes. Research on these programmes is just beginning. There is a need for the evaluation of such programmes against a sound research model. The essential contribution of this paper is to bring the telecommuting related literature together in a manner which allows the development of a preliminary research model for studies of the provision of distance education from the educational institution perspective and for the desire to partake in distance education from an individual perspective. The model brings together the tasks (and the related issues of scheduling and control of work), personal characteristics of the individuals, the perceived advantages and disadvantages of undertaking a course of study in this way and the necessary underlying technology.

REFERENCES

Belanger, F. (1999) "Workers' Propensity to Telecommute: An Empirical Study. *Information and Management* 35, pp. 139-153.

Blanc, G. (1988) Autonomy, Telework and Emerging Cultural Values. In: Korte, W.B., Robinson, S. and Steinle, W.J., (Eds.) *Telework: Present Situation and Future Development of a New Form of Work Organisation*, pp. 189-200. Elsevier Science Publishers. B. V. (North Holland).

Daft, R.L., Lengel, R.H. and Trevino, L.K. (1987) "Message Equivocality, Media Selection, and Manager Performance: Implications for Information Systems. *MIS Quarterly* pp. 355-366.

Daft, R.L. and Macintosh, N.B. (1981) "A Tentative Exploration into the Amount and Equivocality of Information Processing in Organizational Work Units. *Administrative Science Quarterly* 26, pp. 207-224.

Dick, G. N. (2000) "Telecommuting in Australia and Singapore. *Proceedings of The Fifth International Workshop on Telework*, Stockholm

Dick, G. N. and Duncanson, I (1999) "Telecommuting: Does it Work in the Long Term? *Procedings of the 32nd Hawaii International Conference on System Sciences*, January, Hawaii, IEEE.

DuBrin, A.J. (1991) "Comparison of the Job Satisfaction and Productivity of Telecommuters versus In-House Employees: A Research Note on Work in Progress. *Psychological Reports* 68, pp. 1225-1234.

Ellis, T. S. and Webster, R. L. (1997) "Information Systems Managers' Perceptions of the Advantages and Disadvantages of Telecommuting: A Multivariate Analysis. *Hawaii International Conference on System Sciences*, Hawaii, IEEE.

Filipczak, R. (1992) "Telecommuting: A Better Way to Work? *Training* pp. 53-61.

Ford, R.C. and Butts, M.A. (1991) "Is Your Organization Ready for Telecommuting? *SAM Advanced Management Journal* 56, pp. 19-23.

Ford, R.C. and McLaughlin, F. (1995) "Questions and Answers about Telecommuting Programs. *Business Horizons* 38, pp. 66-72.

Gray, M., Hodson, N. and Gordon, G. (1993) *Teleworking Explained*, John Wiley & Sons.

Hamblen, M. (1999) "Merrill Trains Staff to Work at Home. *ComputerWorld* 33 (17) pp. 50

Hesse, B. W. and Grantham, C. E. (1991) "Electronically Distributed Work Communities: Implications for Research on Telework. *Electronic Networking: Research, Applications and Policy* 1,

Hotch, R. (1993) "Managing from a Distance. *Nation's Business* 81 (10) pp. 24-26.

Huws, U., Korte, W.B. and Robinson, S. (1990) *Telework: Towards the Elusive Office*, Chichester John Wiley & Sons.

Katz, A.I. (1987) "The Management, Control and Evaluation of a Telecommuting Project: A Case Study. *Information & Management* 13, pp. 179-190.

Lewis, B. J. (1998) "Tapping into the Benefits of Telecommuting. *Journal of Management in Engineering* 14, pp. 9-10.

Li, F. and Gillespie, A. (1994) "Team Telework: An Emergent Form of Work Organization. In: Baskerville, R., Smithson, O., Ngwenyama, O. and DeGross, J.I., (Eds.) *Transforming Organisation with Information Technology,* pp. 397-418. Amsterdam Elsevier Science (North Holland).

Mannering, J. S. and Mokhtarian, P. L. (1995) "Modeling the Choice of Telecommuting Frequency in California: An Exploratory Analysis. *Technological Forecasting and Social Change* 49, pp. 49-73.

McQuarrie, F. A. E. (1994) "Telecommuting: Who Really Benefits? *Business Horizons* 37, pp. 79-83.

Mokhtarian, P. L., Handy, S. and Salomon, I. (1995) "Methodological Issues in the Estimation of the Travel, Energy and Air Quality Impacts of Telecommuting *Transportation Research A* 29A, pp. 283-302.

Mokhtarian, P. L. and Salomon, I. (1994) "Modeling the Choice of Telecommuting: Setting the Context. *Environment and Planning A* 26, pp. 749-766.

Mokhtarian, P. L. and Salomon, I. (1996a) "Modeling the Choice of Telecommuting 2: A case of the Prefered Impossible Alternative. *Environment and Planning A* 28, pp. 1859-1876.

Mokhtarian, P. L. and Salomon, I. (1996b) "Modeling the Choice of Telecommuting 3: Identifying the Choice Set and Estimating Binary Choice Models for Technology-based Alternatives. *Environment and Planning A* 28, pp. 1877-1895.

Mokhtarian, P. L. and Salomon, I. (1997) "Modeling the Desire to Telecommute: The Importance of Attitudinal Factors in Behavioural Models. *Transportation Research A* 31, pp. 35-50.

Mokhtarian, P. L., Salomon, I., Saxena, S., Sampath, S., Cheung, P., Le, K. and Bagley, M. N. (1994) "Adoption of Telecommuting in Two California State Agencies. *unpublished work*

Nilles, J. M. (1996) "What Does Telework Really Do to Us? *World Transport Policy and Practice* 2, pp. 15-45.

Olson, M. H. (1983) "Remote Office Work: Changing Work Patterns in Space and Time. *Communications of the ACM* 26, pp. 182-187.

Orlikowski, W. J. (1996) "Improvising Organizational Transformation Over Time: A Situated Change Perspective. *ISR* 7, pp. 63-92.

Rice, R.E. (1987) "Computer-Mediated Communication and Organizational Innovation. *Journal of Communication* 37, pp. 65-94.

Starr, M.K. (1971) *Management: A Modern Approach*, New York Harcourt Brace Jovanovich.

Tamrat, E., Vilkinas, T., and Warren, J. R. (1996) "Analysis of a Telecommuting Experience: A Case Study. *Proceedings of the 29th Annual Hawaii International Conference on System Sciences,* Hawaii, USA

Thompson, J. D. (1967) *Organisations in Action: Social Science Bases of Administrative Theory,* New York McGraw-Hill.

Trent, J. T., Smith, A. L. and Wood, D.L. (1994) "Telecommuting: Stress and Social Support. *Psychological Reports* 74, pp. 1312-1314.

Trevino, L. K. and Webster, J. (1992) "Flow in Computer-Mediated Communication: Electronic Mail and Voice Mail Evaluation and Impacts. *Communication Research* 19, pp. 539-573.

Tung, L. L. and Turban, E. (1996) "Information Technology as an Enabler of Telecommuting. *International Journal of Information Management* 16, pp. 103-117.

Turban, E. and Wang, P. (1995) "Telecommuting Management: A Comprehensive Overview. *Human Systems Management* 14, pp. 227-238.

Venkatesh, A. and Vitalari, N. P. (1986) "Computing Technology for the Home: Product Strategies for the Next Generation. *Journal of Product Innovation Management* 3, pp. 171-186.

Venkatesh, A. and Vitalari, N. P. (1992) "An Emerging Distributed Work Arrangement: An Investigation of Computer-Based Supplemental Work at Home. *Management Science* 38, pp. 1687-1706.

Wheeler, M. and Zackin, D. (1994) "Telecommuting. *Work-Family Roundtable* 4, pp. 2-14.

Wood, R. E. (1986) "Task Complexity: Definition of the Construct. *Organizational Behaviour and Human Decision Processes* 37, pp. 60-82.

Yap, C. S. and Tng, H. (1990) "Factors Associated with Attitudes Towards Telecommuting. *Information & Management* 19, pp. 227-235.

ISSUES IN UNIVERSITY ADMINISTRATION SYSTEMS: A REGIONAL AUSTRALIAN CASE

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ABSTRACT

This paper describes some of the major policy issues that occurred during the last fifteen years that were faced by the university and IT management of a regional Australian university. The changing context of the Australian higher education industry during this time is described. An unusual feature of this period described in the paper, is a collaborative systems development project in which most Australian universities participated, but which did not meet its full objectives. Towards the end of this period, the software market for university administration systems became more active, which lead to the adoption of Enterprise Resource Planning systems by this and other Australian universities.

INTRODUCTION

Information Technology (IT) occupies a high profile within Australian Universities. Universities were among the first organisations to acquire computers because of their usefulness in solving mathematical problems. Today computers are used in teaching and research in virtually every discipline. The Internet which originated in response to the needs of researchers now pervades many university activities including advertising and promotion and disseminating teaching materials. As well as being essential to the 'core business' of universities, that is teaching and research, IT has an important role in university administration underpinning the so-called 'back-office' systems that support these core activities. Major university administrative applications include Student Administration, Human Resource Management and Finance.

This paper examines some major issues that have arisen over the last fifteen years and the industrial context in which they are situated, from the perspective of a regional Australian university. Initially some background information on the industrial context is presented.

THE AUSTRALIAN UNIVERSITY SYSTEM

The majority of Australia's 37 universities are publicly funded (only two universities, Bond and the Australian Catholic University are private organisations). Currently (August 2000) they fall within the responsibility of the Federal Department of Employment Training and Youth Affairs (DETYA). The Australian University system is characterised by diversity, even though since 1987 a Unified National System (UNS) introduced by Minister Dawkins, has been in effect. The mains effect of the UNS was to re-designate a number of non-university institutions such as Colleges of Advanced Education, which were more vocationally orientated as universities, along with the traditional academically strong and research orientated 'pre-1987' universities and to promote larger more viable institutions via mergers. Raising the overall number of universities increased the potential for collaborative activities. Another consequence of the 1987 reform was that in all of the newer universities, research which had formerly been a low key activity was placed higher on the agenda with the concomitant refocussing of budgets and institutional effort.

Increased Competition

During the 1990's misgivings arose in government circles about the overall size of the higher education budget. "The link between the public investment and return on this investment in terms of visible national revenue has not always been clear and obvious to the tax-payers, or for that matter to the Government (Hamilton 1997). In an era of economic rationalism there is less inclination to pursue public good that results in private benefit. Commenting on the West Higher Education Review, committee member and Central Queensland University (CQU) Vice Chancellor and President Lauchlan Chipman commented. "One of the most difficult questions ... is whether the benefits of higher education are primarily private benefits - benefits to the individual graduate - or primarily public benefits - benefits to society at large. The case for public subsidy is based on the idea that there is a significant social benefit. The case for requiring the student to contribute is based on the idea that a degree brings significant personal advantages, especially in job opportunities, total lifetime earnings, geographical mobility, and social class ('status') mobility (Chipman 1997). These attitudes have coincided with a decrease in the level of government support for publicly funded universities. "Where once the Government provided about 90% of university funding in 1983 by 1997 this had declined to about 57% (Hamilton 1997). Surprisingly this decline in government funding was accomplished at a time when there was a considerable increase in the number of students enrolled. Some of this increase came from full fee paying overseas students, which was one way in which universities responded to the contraction in government support. Increased competition for students tended to create a more competitive atmosphere in the Australian University industry during the period under examination.

> The biggest challenge for the AV-CC is that as vice-chancellors we agree on less and less. Each of us has a duty to do what we can to advance the interests of our own university, and each of us has a national duty to contribute our expertise and experience to shaping policy for the higher education sector in Australia as a whole. (Chipman 1999b)

This change in market focus created additional demands for management information.

CASMAC

Public funding remains important to Australian universities, accounting for at least 50% of revenues in many cases. Public funding implies public accountability, which means that universities must provide various statistics to DETYA to enable a degree of public monitoring. The gathering of statistics is a type of information request to which universities would like to be able to respond expeditiously through the use of IT. The fact that many university student record systems were developed during the 1970s using 3rd generation software technology meant that for many universities it was a struggle to keep pace with changing requirements for information from government. A characteristic of IT systems of this era (ie the 1970's) is that they are relatively inflexible and do not lend themselves easily to changed requirements. Difficulties in meeting information requests from government lead universities to consider a cooperative approach to IT systems development.

The **Core Australian Specification for Management and Administrative Computing** (CASMAC) steering committee was formed in 1989 by the Australian Vice-Chancellors' Committee (AVCC), the council of Australia's university presidents. The AVCC is the peak organisation representing Australian universities nationally and internationally and seeks to advance higher education through voluntary, cooperative and coordinated action.

CASMAC is based on a similar project initiated in 1988 by the University Grants Committee (UGC) in the United Kingdom that became known as the Management and Administrative Computing (MAC) initiative. These projects were undertaken because of the difficulties being experienced by universities in maintaining and redeveloping administrative systems in order to satisfy increasing demands for information from government.

As the demands for information came from the government the same demands were placed on all universities. Both CASMAC and the UK MAC initiative were based on the premise that there was a high degree of commonality in the core functionality needed to support the administrative and management functions of universities. The AVCC believed that there were benefits to be obtained by specifying these requirements and sharing the development and ongoing costs of the resulting systems.

The Steering Committee was successful in its bid to the Department of Employment, Education and Training (DEET) for funds to undertake a feasibility study to determine if a similar approach to MAC could be applicable in Australia. As a result of the feasibility study, it was agreed to proceed with the preparation of the Core Australian Specification for Management and Administrative Computing. Between April 1991 and July 1991 a small technical specification team together with consultants from Price Waterhouse used the MAC blueprint as a base to develop CASMACo. From December 1991 to May 1992 progressive revisions were made to the specifications. CASMAC specifications use the structured system specification techniques of data flow diagrams, data model diagrams and a data dictionary. It has been suggested that the specification may cover 80% of each university's functional requirements but this is obviously a very rough assessment of something that can not really be quantified.

CASMAC is intended to meet the following **four objectives:**

Objective 1:

Specify and maintain the core functional requirements necessary to support the business and management functions of Australian universities.

Objective 2:

encourage and provide the basis for cost effective collaborative development and acquisition of adaptable and integrated core administrative computing applications which will:

1. meet Australian universities' core operational and information requirements;
2. provide the means of complying with statutory responsibilities and managerial obligations in a timely manner; and
3. facilitate the effective deployment of university resources.

Objective 3:

maximise the ability to respond to external reporting requirements, particularly those of government, in a cost effective and timely manner.

Objective 4:

allow for the flexible adoption and/or exploitation of new and evolving technology and facilitate the implementation of innovative approaches for management and administrative systems.

The national Core Australian Specification for Management and Administrative Computing defines the core functional requirements of the management and administrative needs of Australian universities for:

Student Systems
Human Resources
Finance Systems
Physical Resources
Research and Consultancy
Executive Reporting

(AVCC 1997)

While the term 'CASMAC' technically refers to only the core specification it is often used to include those dimensions of the project that emerged subsequently.

In July 1992 a Request for Information (RFI) was issued to potential suppliers of systems which would meet the requirements specified in CASMAC. This RFI required suppliers to indicate how they might deliver CASMAC-compliant applications to universities and to address a range of specified issues. Nineteen responses were received. A Request for Tender (RFT) was issued to five potential suppliers shortlisted from the evaluation of the RFI. The responses received were evaluated against the following criteria: CASMAC compliance, cost, company/consortium profile, technology platform, time frame and delivery schedule, control/ownership/support and adaptability and customisation capability.

Between January 1993 and March 1993 universities were invited and encouraged to commit to a collaborative group project based on one of the suppliers responding to the RFT. Such a commitment would involve:

agreement to meet a share of the total cost of achieving the CASMAC objective through a joint venture with that supplier;

> representation on the Management Committee established to oversee the project;
> commitment to the provision of resources in the form of staff time and expertise for systems development, testing and implementation; and
> no commitment for an institution to take any of the applications with timing of implementation at the discretion of the institutions.
> (AVCC 1996)

In April 1993 based on the responses to this invitation the Steering Committee recommended to the AVCC that an agreement be signed with two selected suppliers, Oracle and Coulson Heron Associates (CHA), and that Management Committees for each project be established, reporting to the CASMAC Steering Committee. During the following weeks, 19 universities committed to forming a consortium based on the CHA proposal using the PowerHouse fourth generation development language. This consortium was subsequently called UniPower.

> The UniPower consortium has been the first to announce details of the system it is developing. On the 27th July 1993 it signed a $10.5 million deal with British software house Coulson, Heron and Associates (CHA) and Canadian-Us software house Cognos to begin development of the system based on the software developed by CHA in the UK. The $10.5 million software cost will be spread over the 19 universities with contributions being determined by the relative size of each. (The contribution of CQU being $185,683).
> (CASMAC Bulletin #1, 1994)

Of these 19 universities, 16 were already using Cognos (Powerhouse) products.

> For UCQ[1] the decision to join the Powerhouse family was easier as there was already a strong Powerhouse presence with the existing Student Record application being written in the Powerhouse 4GL language.
> (CASMAC Bulletin #1, 1994)

In the same period 11 other universities committed to forming a consortium which would use the Oracle relational database management system. This consortium was subsequently called the UniOn Group. Significantly, both successful tenderers were also successful in the UK tender process and, therefore, had already developed a set of systems that could be used as the basis for the Australian systems. Neither group appears to be particularly biased with respect to the inclusion or exclusion of 'pre-1987' universities.

Later in 1993, three of the remaining universities, known as the Natural Group, agreed on a Memorandum of Understanding for the joint development, acquisition and exchange of CASMAC compliant software based on the Natural fourth generation language. The four other universities either determined to develop their own software in-house or to acquire software from other vendors. DEET allocated $2.7 million to the UniPower consortium in 1993. This project eventually ran into problems and no useful systems were developed. Legal proceedings were instigated by the consortium in 1997 to seek recompense for this failed investment.

> For many IT investment decisions in universities, the question is not 'should we invest' but 'where and how to invest'. It is often not a choice of whether to develop, upgrade, or replace a system, but which system will efficiently deliver the required benefits, and how should it be obtained and installed. For such a system, which could be termed an operational or competitive necessity, 'return on investment' is not usually a very relevant measure. Where the system is fundamental to running the organisation and delivering services, there may be no choice but to invest. In many cases, and especially in the public sector, it is difficult to quantify all of the costs and benefits (Stacey 1993). This may cause some universities to neglect the cost-benefit analysis of proposed IT projects. Some of these will be operational or competitive necessities, which will not give you any competitive advantage, but will keep you in the game and thus are necessary for survival.
>
> Many university administrative IT projects would fall into this category. In attempting to address the need for such systems, most universities have collaborated in the CASMAC initiative. Collaborative development has been proposed as a way to share the costs of developing standardised IT systems for areas such as finance, human resources, student administration and management information.
>
> The objectives for CASMAC include cost-effective collaborative development and acquisition of administrative systems to meet the operational and information requirements of the universities, and especially to enable a standardised response to the universities' statutory requirements and external reporting responsibilities to government.

> The collaborative focus of CASMAC was therefore intended to provide a framework for institutional development, towards which universities could migrate in the knowledge that systems obtained from other universities, or possibly developed in conjunction with other universities, would have minimum integration problems.
>
> In addition, this separation of the project from individual universities seems to have led to a distancing from, and lack of ownership by, university line management, even though the development process involved considerable consultation, and software development teams usually included application specialists from within the universities. The interviewers often heard both university IT managers and senior administrators say they were not focused on the administrative systems of the institution because they were 'waiting for CASMAC'. It did not have senior management attention, although some did express concern about how long it was taking to get UniOn or UniPower systems in place. These delays meant that 'interim systems' were sometimes being developed or purchased by some universities to meet the immediate needs of the institution.
>
> Competition between universities has grown since CASMAC began in 1991, and this is leading to increasing strategic differentiation. Perhaps this changing strategic focus within universities has contributed to the lack of attention to and 'ownership' of the CASMAC initiative by individual universities.
> (Vitale et al 1997)

INFORMATION SYSTEM DEFICIENCIES

CQU decided that their Finance and HR systems would need replacing before a solution would become available from UniPower. Consequently interim stand-alone systems for Finance and HR were purchased and installed in 1991 and 1993 respectively.

Changing reporting requirements for government, new management requirements for information because of a changing student profile, including full fee paying overseas students, an increase in research activity plus an awareness of newer and superior IT appearing in the market highlighted the inadequacies of current IT systems.

> In 1997 CQU was faced with a number of issues. The existing student record system had been designed on a model that had a single campus, recognised two semesters, was not Year 2000 compliant and used an inappropriate database structure. A decision by the University to operate over four terms rendered the existing system inoperable. There were no commercial systems in the market that would solve this problem in the required time frame. An in-house project was initiated to amend the existing system to cater for four terms, to make it Year 2000 compliant, to change the database platform, and to cleanse the data. The structure and processes used by this system were largely undocumented and posed a potential risk to the University. It was recognised that considerable resources would be required to address these issues and that the potential returns would be minimal.
>
> The Vice-President (Administration) called all interested parties to a meeting to review the student system on 7th August 1998. That meeting identified a number of outstanding issues in relation to the system. It was also recognised that many of the problems stemmed from the outdated and often redundant processes that are associated with the system. This issue along with a proposed review of IT provision and services was referred to the monthly meetings of the University's Senior Management Group. The group met on two occasions to address the matter. Following further discussions with the Associate Deans of Teaching and Learning it was agreed that whilst a University-wide review of IT was important the greater need was to improve the University's administrative processes. The Director Information Technology Division (ITD) was then requested to develop an appropriate RFP.
>
> The RFP was developed as a result of a series of meetings and discussions amongst ITD, the administrative functional areas, the Associate Deans Teaching and Learning and key faculty based users. The RFP had a primary focus o Student Administration but also addressed the University's long-standing requirement for integrated systems and in addition requested proposals for Financials and Human Resource systems. The RFP was released on 7th December 1998 and sent to the three potential providers of Student Systems in Australia. These providers were PeopleSoft Australia, Deakin Software Services and Technology One.
> (Central Queensland University Integrated Systems Project Final Report May 1999)

Two of the three potential providers, Deakin Software Services and Technology One were Australian software houses offering systems that had originated from the CASMAC project (see Figure 1). PeopleSoft are an American company with an international presence in the Enterprise Resource Planning (ERP) system market. Their ERP product is primarily recognised as having a strong HRM capability, however they have developed Student systems for universities from an American base which have been adapted to Australian an New Zealand requirements. Following a process that evaluated the responses from these providers, PeopleSoft Australia was selected as the preferred software supplier for CQU on 12 March 1999. Eleven Australian universities are reported as having signed contracts to adopt PeopleSoft systems (The Australian April 26 2000).

The CQU RFP did not express CASMAC compliance as a general requirement, opting instead for:

> Complies with Federal and State legislation. Also enables the University to satisfy the reporting requirements of government bodies such as DETYA, ATO, and ABS and other external bodies.
> (CQU Request For Proposal 7th December 1998)

The interest the University had in more efficient administrative processes is evident in:

> Facilitates Business Process Re-engineering, including Work Flow automation as a design concept across all modules.
> (CQU Request For Proposal 7th December 1998)

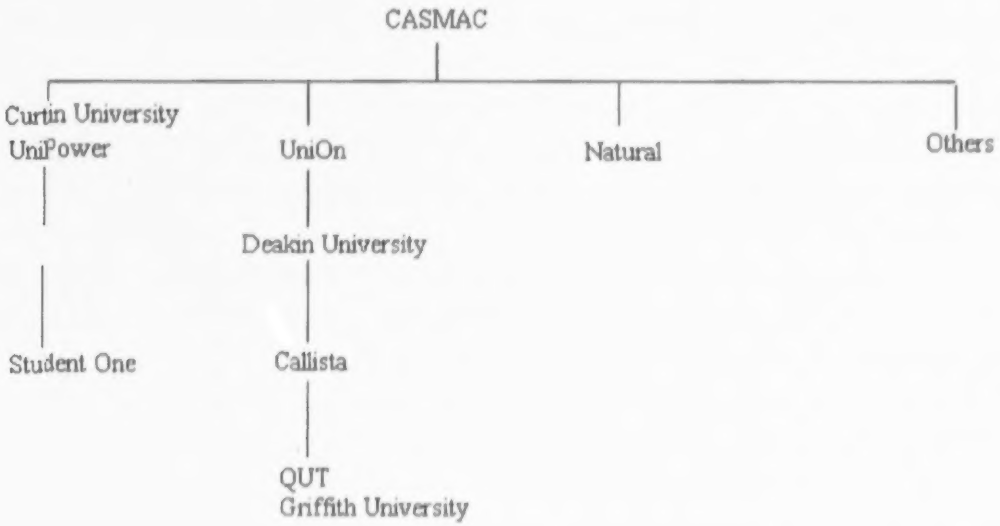
and reflecting the limitations of existing systems and hopes for the future in:

> Rapid changes in the higher education environment make it imperative that any administrative computing systems put into place do not constrain future courses of action.
> (CQU Request For Proposal 7th December 1998)

Even if a full cost benefit analysis of the impact of installing new IT systems has not been performed, possibly because of the complexity of the calculation, there seems to be an implicit assumption that savings will eventuate.

> Many of the savings that are part of the pay-off of new systems arise because their imminent arrival disciplines us to review the processes and transactions through which the organisation conducts its internal and external business. (These are reviews we should be conducting in any case.) We must conform our processes to the systems we are purchasing, and not the other way round. (Chipman 1999a).

Figure 1. System Development From CASMAC



These savings are not achieved directly through the IT budget, by replacing ageing costly to maintain systems with newer systems requiring less maintenance expenditure but from revised business processes. The introduction of the new integrated IT systems creates the opportunity to introduce new business processes that are more efficient than their predecessors. Projects like PeopleSoft project at CQU are not simply IT projects designed to produce better information for managers and government but are also instruments of business change and institutional reorganisation and restructuring. In this sense the current PeopleSoft project has a different emphasis and rationale from the earlier CASMAC project.

QUESTIONS FOR DISCUSSION

1. What are the advantages and disadvantages of collaborative IT projects in a particular industry?
2. What are the implications of this account to theories of strategic information systems development for competitive advantage?
3. What appeared to be the determining factor in the decision regarding which consortium to join?
4. How do you account for the comparative success of the PeopleSoft product in Australia? What impact did the collaborative CASMAC project on have on individual IT managers in universities?
5. Do you view the CASMAC project as a positive or a negative experience for Australian universities?
6. What alternative outcomes may have emerged had the CASMAC initiative not occurred?
7. Do you think the basis for making a decision to invest in IT systems is different for public and private organisations? Is there evidence suggesting the application of more formal investment decision making in the commercial sector? Do you agree that the necessity to invest in an IT project can be assessed in the absence of financial criteria?
8. What criteria would you apply to the selection process at CQU when it needed to choose between the respective products from PeopleSoft, Deakin Software Services and Technology One?
9. How would you define the role of an IT department when all of the significant administrative systems operated by the organization are packaged software products?

ACKNOWLEDGMENT

The assistance of Ian Jenkins, Director of the Information Technology Division, Central Queensland University is gratefully acknowledged for advice and assistance and material for this Case Study.

ENDNOTE

1. CQU (Central Queensland University) was formerly named UCQ (University of Central Queensland).

REFERENCES

AVCC (1996), Http: http://www.avcc.edu.au/avc/casmac/casmachist.html.

AVCC (1997), Http: http://www.avcc.edu.au/avc/casmac/index.html.

CASMAC Bulletin #1 (1994) CASMAC Project Office, ITD, UCQ. January.

Central Queensland University. (1998) Request For Proposal Administrative Information System.

Central Queensland University Integrated Systems Project Final Report May 1999.

Chipman L. (1997) in CQU UniNews #187.

Chipman L. (1999a) in CQU UniNews #266.

Chipman L. (1999b) in CQU UniNews #288.

Hamilton S. (1997) AO Executive Director Australian Vice-Chancellors' Committee, (9-11Jun 1997) Policy Implications for Australian Universities in their Economic Development Enhancement Role, American-Australian Conference on Strengthening Post-Secondary Education's Contributions to Economic Development. HTTP http://www.avcc.edu.au/avcc/speeches/sh110697.htm.

Stacey, R. (1993) *Strategic Management and Organisational Dynamics*, Pitman.

Vitale, M. & Johnston, K. (1997) 'Management Processes: Evaluating IT Investments' in Yetton P et al (ed) *Managing the Introduction of Technology in the Delivery and Administration of Higher Education* DEETYA, ISBN 0 642 23634 8.

STRENGTHS AND WEAKNESSES OF AN INFORMATION SYSTEMS PROGRAM: A LONGITUDINAL ASSESSMENT OF STUDENT PERCEPTIONS

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ABSTRACT

Nowhere in the applied business disciplines is the need for continuous monitoring and improvement of university degree programs more paramount than in information systems (IS). IS programs, by their very nature, must constantly evolve if they are to maintain a reasonable level of currency with rapidly changing state-of-the-art technologies and industry practices that leverage them. The importance of assessing the quality of such programs is underscored by the fact that performance assessment is becoming an increasingly important issue in accreditation decisions. Ideally, such assessments help universities evaluate the quality of the services they provide to their various constituencies and provide a mechanism for identifying strengths and weaknesses of their programs. In this paper we describe a methodology that is being used to assess strengths and weaknesses within an information systems degree program. The identification of these strengths and weaknesses is a preliminary step in the development of a larger and more encompassing performance assessment model.

INTRODUCTION

The idea of formal "performance assessment" processes in higher education is relatively new. Although it has not always been the case, AACSB standards now specify that degree programs should be systematically monitored to assess effectiveness and periodically revised to reflect new objectives and improvements based on contemporary theory and practice. To satisfy this standard, a school must demonstrate that processes exist for "planning, monitoring and revising" curriculum, and that these processes do indeed result in new or revised curriculums. AACSB guidelines further suggest that these processes should include an analysis of the educational outcomes as viewed by various stakeholder groups. Despite this accreditation requirement, few published reports of program assessment processes for business programs in general (and information systems programs specifically) can be found in the literature.

A review of the IS literature suggests that a number of researchers have examined the needs of employers of IS graduates from the standpoint of identifying the knowledge and skill sets most often demanded in the marketplace (Rogers et al., 1999; Athey and Plotnicki, 1992; Jacobson and Armstrong, 1996; Todd et al., 1995; Wilson, 1996; Case et al, 1997; Cheney and Lyons, 1980; Harris & Harris, 1997; Kahn and Kukalis, 1990; Leitheiser, 1992; Nelson, 1991; Padgett et al., 1991; Young and Lee, 1997). Similarly, IS researchers have studied the knowledge and skills deemed most useful and/or important by graduates of various IS programs who are now employed as IS professionals (Doke and Williams, 1999; Womble, 1994). This body of research provides some important insight into the views of the employer and alumni stakeholder groups with regard to the currency of IS curriculums. Less attention, however, has been given to the perceptions of students nearing graduation, and in particular, if and how their views of the value of their education (and the associated strengths and weaknesses of their degree program) change over time as they become an integral part of the IT workforce.

In a recent search of business and education citation databases, only a few articles could be clearly identified as addressing performance assessment in higher education at the institutional and/or "degree program" levels (Haksever and Muragishi, 1998; Johnes, 1996, 1998; Hager and Butler, 1996), and only one specifically addressing performance assessment of IS programs (Weistroffer & Gasen, 1995). While our literature search cannot be considered fully exhaustive or definitive, there is clearly a paucity of research addressing these issues.

PRELIMINARY PERFORMANCE ASSESSMENT ISSUES

The development of meaningful assessment indicators for IS degree programs must take into account the perceptions of various constituent groups, as well as "hard data" related to various inputs and outputs. Several constituencies of IS degree programs can easily be identified, those being students, faculty, graduates, and employers of those graduates. Because of their involvement in and knowledge of information systems programs and the industry as a whole, these groups are in a position to provide valuable insight regarding the perceived quality of IS degree programs. The important questions for the current study revolve around the identification of key strengths and weaknesses of an IS degree program.

Previous research in IS education has focused on the identification of knowledge and skill sets desired by those that hire IS graduates and related curriculum development efforts. The majority of these studies have been motivated by the need to steer IS degree programs to properly match the ever-changing requirements of the IS industry, and thus have focused on the perspective of the employer constituency. These studies provide assistance in identifying what are considered to be important core competencies of IS graduates — the "outputs" of IS degree programs — as seen by this important, external constituent group. From the standpoint of program assessment, however, an even more basic question is how well an IS program is meeting the needs dictated by these core competencies. In other words, a preliminary step in the performance assessment process is determining what key stakeholders (students, alumni, employers and faculty) see as the strengths and weaknesses of a given degree program. A related and interesting question is whether perceptions of strengths and weaknesses are consistent across the various stakeholder groups and within groups over time.

The strengths and weaknesses of any given program encompass a wide array of factors. These clearly include but extend well beyond pedagogical issues such as curriculum content and currency. For example, resources such as buildings, computing facilities, availability of internships, student/teacher ratios, and faculty expertise, as well as services such as academic advising, career planning, and job placement come into play. Behavioral and attitudinal factors may also be included. In particular, changes in student attitudes (tolerance, respect for others, valuing diversity, etc.) have been identified as important outcomes in the education literature (Travis, 1996; Haksever and Muragishi, 1998).

The purpose of this study is to identify the strengths and weaknesses of an IS degree program as viewed by graduating seniors and by alumni. The results will be used in a larger study aimed at the development of a performance assessment model that can be used for continuous evaluation of IS programs.

METHODOLOGY

In an effort to address some of the issues on program effectiveness as they relate to the BBA with a major in Information Systems, current and former students were surveyed on the strengths and weaknesses of the information systems program/curriculum at a public, regional, comprehensive university in the southeastern United States. The groups surveyed during the first iteration of the project were those enrolled in senior-level IS courses (CISM 4xxx) during Spring 2000 and alumni who graduated in 1998 and 1995. One goal of the exercise is to determine if these groups identify similar or dissimilar strengths and weaknesses. The results of the survey will become one component of an ongoing program assessment.

Data collection for this study was facilitated by the availability of tables from our university's data warehouse. The university's data warehouse includes an alumni table containing information on alumni such as name, degree, major, graduation date, home address, home phone, home e-mail, job-code, business phone, address, etc. One negative of the table is that it does not have complete information on all those in the table. However, the table did provide us with a set of data from which alumni, by year, could be identified and contacted. Given the relatively small number of alumni in the two years of interest (69 graduates in 1998, 41 graduates in 1995, for a total of 110 in all), a decision was made to mail a survey to each and every one of these alumni, rather than selecting a random or stratified sample. Follow-up attempts were later made to contact these alumni via phone and/or e-mail (when such information was available) to encourage participation.

The survey instrument for this study was developed during the Spring 2000 semester and used to survey students enrolled that term in senior-level (CISM 4xxx) courses. (See Appendix A.) The instrument was subsequently used for the alumni survey during summer 2000. It should be noted that a system-wide change from academic quarters to semesters occurred in the Fall of 1998. As a result of this transition, all courses at the university were renamed and renumbered. Thus, courses are identified on the survey instrument by both their quarter-system and semester-system equivalents. Concurrently with the quarter-to-semester transition, a few courses that had previously been required in the IS curriculum (such as Applications Development with COBOL) became electives, and some that had previously been electives (such as Information Resource Management) became required. Several new courses (such as Project Management) were added, and others (such as the introductory programming course) were significantly revised and updated in terms of the content and/or tools being used. (For example, the language used in the introductory programming course shifted from Pascal to Java).

Because this is an exploratory study, the survey instrument was purposefully designed to contain only open-ended questions. Although a few of items that could be considered as strengths or weaknesses were given as examples, only blank lines were given for the respondents to fill in. This allowed for the widest possible range of responses, from which patterns would hopefully emerge.

RESULTS

Response rates from both the student and alumni groups were very low. Of the 81 students asked to participate in the Spring of 2000, only 13 (or 16%) completed the survey. Results for alumni were, unfortunately, even lower. Five of the 110 surveys sent to alumni were returned as "undeliverable". Of the 105 remaining, only 8 (or 7.6%) responded. The poor response rate among alumni is partially attributable to the poor quality of the university's alumni database. This became apparent as follow-up attempts to encourage participation were made. Phone numbers and email addresses were seldom available, and when available, were often wrong. While we believe the "personal touch" would have improved the response rate significantly, we also realize that IS graduates tend to change jobs (and locations) frequently, seldom notifying the university of such moves. As a result, we believe that the quality of the alumni database will continue to be problematic, and consequently, we will need to find (or develop) better sources of alumni data for future studies. On the other hand, we believe that the response rate among seniors can be improved dramatically by asking these students to complete the survey at the same time that they complete evaluations of teaching effectiveness. Student evaluations of teaching effectiveness are given in all classes every Fall and Spring semester. We plan to use this approach in our next data gathering cycle.

The data collected for this study were analyzed with basic, categorical data analysis techniques. Tables 1 through 5 summarize the results for each of the five questions.

DISCUSSION

Strengths

An examination of Table 1 reveals that alumni and seniors view the strengths of the IS program similarly in most respects, with a few notable exceptions. Both groups view faculty as the dominant strength, both in terms of the quality of the faculty and their approachability, availability and concern for the student. Both groups also view courses as a strength of the program, but they differ in terms of the "focus" seen as important within those courses. Alumni viewed the foundation in business and the emphasis on long-term, underlying principles as strong points, while seniors indicated strengths in terms of an emphasis on teamwork and hands-on projects. While it cannot be determined from the data gathered, it is possible that the emphasis on teamwork and projects indicated by the seniors represent some of the "long-term principles" indicated by alumni.

Both groups saw lab hours as a strength. Interestingly, however, the two groups differed substantially on their views of the lab equipment. Alumni viewed the labs as a strength to a much greater extent than did the students. This may suggest that alumni develop a greater appreciation for the quality of the labs once they have worked in the field and had more exposure to other computer facilities and operating environments.

Internship opportunities were noted by both groups as a program strength, however, only seniors indicated strengths with respect to employment opportunities and job placement. Seniors mentioned guest speakers as a strength much more frequently than did alumni. Seniors also noted support staff, classroom technologies, class size, and the overall breadth and direction of the program as strengths; these were not noted by alumni.

Weaknesses

While the two groups viewed strengths similarly, they viewed weaknesses very differently. (See Table 2). None of the alumni who responded noted any weaknesses in terms of the faculty. A few weaknesses relating to faculty were, however, noted by seniors. These included the English-speaking skills of some faculty, failure to match courses to faculty strengths, and examination and evaluation policies utilized by some faculty.

Interestingly, while "courses" were noted as a strength by both groups, they were also noted (in fairly equal numbers) as a weakness by both groups. Students and alumni alike indicated a need for more hands-on projects and continuing effort to keep course topics up-to-date. Seniors repeatedly mentioned the need for more sections of courses, particularly more sections of IS electives; alumni, however, did not mention this at all. Seniors also indicated a desire for fewer business courses and more IS courses (which is somewhat at odds with the "focus on business" strength noted by alumni), as well as a desire to be allowed to choose a "focus area" within IS.

While respondents in each group viewed internship opportunities as a strength, several alumni indicated this as a weakness, suggesting that more internship opportunities need to be made available. This may be due to the fact that alumni are more likely to recognize the value of an internship experience. Both groups indicated a need to provide more encouragement for students to complete internships. Along similar lines, alumni suggested a need to develop more networking and/or job shadowing opportunities with IS professionals, as well as a need to provide more guest speakers; these issues were not mentioned by seniors as weaknesses, although seniors did express a desire for more help in finding internships and jobs.

A final weakness mentioned by seniors but not by alumni had to do with staffing. Specifically, seniors mentioned a need for more tutors, more faculty, and more lab assistants.

TABLE 1
QUESTION 1:
STRENGTHS OF THE IS PROGRAM

	Number of Times Mentioned	
	By Alumni	By Seniors
Faculty		
General (quality, knowledge, etc.)	7	12
Approachability, availability, concern, etc	2	4
Courses		
General	3	6
Focus on business, long-term principles	2	
Focus on teams		3
Focus on hands-on projects		1
Class size		1
Curriculum		
Overall program breadth & direction		3
Labs		
Equipment	5	3
Lab hours	3	5
Internships		
General		2
Internship opportunities	2	2
Employment opportunities/job placement		2
Guest Speakers	1	5
Support staff		1
Technology in classrooms		1

TABLE 2
QUESTION 2:
WEAKNESSES OF THE IS PROGRAM

	Number of Times Mentioned By Alumni	By Seniors
Faculty		
General		1
English-speaking skills		2
Not matching courses to faculty strengths		1
Testing/grading policies		2
Courses		
General	1	
More hands-on/teach in labs/projects	3	5
Need to update/more hot topics	2	2
More time for projects		1
More sections of electives needed		7
Curriculum		
Include less business courses, more IS		1
Not allowed to have focus area within IS		1
Labs		
Equipment not working properly		6
Equipment in networking lab	1	2
Availability to IS student	1	5
Internships		
Opportunities	3	
More encouragement/requirement to do	1	2
Employment opportunities/job placement		
Networking/job shadowing opportunities	3	
Help in finding internships & jobs		1
Guest Speakers	4	
Staff		
Support staff	1	
Tutors needed		1
More faculty needed		1
Not enough lab assistants		1

Most and Least Valuable Courses

Tables 3 and 4 summarize the viewpoints of seniors and alumni with respect to the most and least valuable courses in the IS curriculum. The two groups were very similar in terms of the course that contributed the most to their preparation, but differed with respect to the course seen as "least valuable". Courses in the "heart" of the IS core (Applications Development, Systems Analysis and Design, Data Communications, and Data Management) were the most valuable to both groups. Interestingly, seniors indicated Systems Analysis and Design as the "top" course, followed by Data Communications, then Data Management. This order "flip-flopped" with alumni, who gave the top honor to Data Management, with Data Communications and Systems Analysis and Design tying for second place. This suggests that both groups recognize the importance of the underlying concepts and principles that comprise the fundamental core of the IS curriculum.

There is a much wider disparity of opinions with respect to the least valuable course, particularly among seniors. This is quite possibly due to the fact that many seniors simply do not know yet where their careers will lead them and have little or no experience upon which to base their answers. The course most frequently mentioned as "least valuable" by seniors was Data Management. This perspective is not shared by alumni, however, none of whom mentioned this course as "least valuable" and many of whom mentioned it as "most valuable". The overwhelmingly "least valuable" course to alumni was COBOL. COBOL was mentioned as "least valuable" in more of the alumni responses than the senior responses. This supports the trend in industry to move away from COBOL for new development projects, and is no doubt influenced in this study by the fact that COBOL was (but is longer) a course required in the IS core. Another interesting difference in the least valuable course centers on the other programming course (Applications Development with Java). Relatively speaking, fewer seniors than alumni view this course as "least valuable". This difference of opinion may come about as a result of the "normal" career path taken by IS graduates, many of

TABLE 3
QUESTION 3:
WHICH COURSE (CONTENT) CONTRIBUTED THE MOST TO PREPARE YOU FOR YOUR FUTURE IN THE IS FIELD?

		Number of Times Mentioned By Alumni	By Seniors
CISM 3130	(Applications Development	1	2
	with Java)	2	5
CISM 3134	(Data Communications)	2	7
CISM 3135	(Systems Analysis Design)	3	3
CISM 4134	(Data Management)		1
CISM 4135	(Project Management)		
CISM 4136	(Global Info. Resource Mgmt.)		
CISM 4234	(Applications Development with Objects)		1
CISM 4235	(Applications Development with COBOL)		1
CISM 4236	(AS 400 and Its Applications)		
CISM 4237	(Decision Support Systems)		
CISM 4238	(Network Administration)		
		1	1

Note: Some participants mentioned more than one course in their response to this question.

TABLE 4
QUESTION 4:
WHICH COURSE (CONTENT) DO YOU BELIEVE WILL BE THE LEAST VALUABLE TO YOU IN YOUR CAREER?

		Number of Times Mentioned	
		By Alumni	By Seniors
None			2
Not sure			1
CISM 3130	(Applications Development with Java)	2	2
CISM 3134	(Data Communications)		1
CISM 3135	(Systems Analysis and Design)	1	3
CISM 4134	(Data Management)		5
CISM 4135	(Project Management)		1
CISM 4136	(Global Info. Resource Mgmt)		2
CISM 4234	(Applications Development with Objects)		
CISM 4235	(Applications Development with COBOL)	3	1
CISM 4236	(AS 400 and Its Applications)		
CISM 4237	(Decision Support Systems)		1
CISM 4238	(Network Administration)	1	1

Note:Some participants mentioned more than one course in their response to this question

whom begin as programmers but quickly move into other specialty areas within IS. Alumni may view programming courses in general as "less valuable" s a result of making this transition in their own careers.

Course in Which You Learned the Most

The Data Management course is viewed as the winner in this category by both alumni and seniors. Othercourses frequently mentioned by both groups include those in introductory programming, data communications, and systems analysis and design.

LIMITATIONS

The results of this study are obviously limited by the low response rate. When viewed as a pilot study, however, the results are nonetheless valuable. The results will be incorporated into the next iteration of this study to (1) improve the content of the instrument and (2) increase the response rate. By repeating this study each semester and building an on-going data set, we hope to develop a performance assessment model that can be used in other similar IS programs. As data are eventually collected across multiple universities, a better understanding of performance assessment measures should emerge.

TABLE 5
QUESTION 5:
COURSE IN WHICH YOU FEEL YOU LEARNED THE MOST

		Number of Times Mentioned	
		By Alumni	By Seniors
CIS 381	(Introduction to Programming)	1	1
CISM 3130	(Applications Development with Java)		2
CISM 3134	(Data Communications)	2	2
CISM 3135	(Systems Analysis and Design)	1	1
CISM 4134	(Data Management)	4	5
CISM 4135	(Project Management)		1
CISM 4136	(Global Info. Resource Mgmt)	1	
CISM 4234	(Applications Development with Objects)		1
CISM 4235	(Applications Development with COBOL)		1
CISM 4236	(AS 400 and Its Applications)		
CISM 4237	(Decision Support Systems)		1
CISM 4238	(Network Administration)		1

Note: Some participants mentioned more than one course in their response to this question

SUMMARY

This paper has reported the results of an initial performance assessment study undertaken to identify the strengths and weaknesses of an IS program as viewed by alumni and graduating seniors. There were more similarities between groups than differences, particularly with respect to strengths of the program. Major strengths identified by both groups included faculty, courses, and lab facilities. Weaknesses identified most frequently by seniors included the need for more sections of electives and better/more lab facilities. Primary weaknesses noted by alumni included the need for more interaction with IS professionals and the need to keep the curriculum up-to-date. This paper represents an initial step in an on-going study. The results will be used to refine and improve the methodology, and ultimately, to devise a useful model for performance assessment in university-level IS programs.

REFERENCES

American Assembly of Collegiate Schools of Business (1994-1995). "Achieving Quality and Continuous Improvement Through Self-evaluation and Peer Review."

Athey, S., & Plotnicki, J. (1992). "A Comparison of Information System Job Requirements in Major Metropolitan Areas." *Interface: The Computer Education Quarterly, 13(4),* 47-53.

Case, T. L., Price, B. A., & Rogers, C. (1997). "The Information Systems Industry: What Abilities Does it Want from its New Hires?" *Proceedings of the 12th Annual Conference of the International Academy for Information Management*, Atlanta, Georgia, 146-152.

Cheney, P.H., & Lyons, N.R. (1980). Information System Skill Requirements: A Survey." *MIS Quarterly*, 4(2), 35-43.

Doke, E. R., & Williams, S.R. (1999). "Knowledge and Skill Requirements for Information Systems Professionals: An Exploratory Study." *Journal of Information Systems Education, 10(1),* 10-18.

Gasen, J. B., Weistroffer, H. R., & Haynes, K. (1991-1992). "Development of an Instrument for Assessing MIS majors : Results of a Pilot Study." *The Journal of Computer Information Systems, 32(2),* 21-22.

Haksever, C., & Muragishi, Y. (1998). "Measuring Value in MBA Programmes." *Education Economics*, 6(1), 11-25.

Harris, A. L., & Harris, J. M. (1997). "What Does the Marketplace Look like for IS Graduates?" *Proceedings of the Southeast Decision Sciences Institute*, 143-145.

Jacobson, C. M., & Armstrong, R. D. (1996). "What IS Employers Want: a Survey of Job Advertisements in the Middle Atlantic States." *Proceedings of the 11th Annual Conference of the International Academy for Information Management*, Cleveland, Ohio, 43-50.

Kahn, M. B., & Kukalis, S. (1990). "MIS Professionals: Education and Performance." *Information and Management, 19(4),* 249-255.

Leitheiser, R. L. (1992). "MIS Skills for the 1990's: A Survey of MIS Managers' Perceptions." *Journal of Management Information Systems*, 9(1), 69-91.

Nelson, R. R. (1991). "Educational Needs as Perceived by IS and End-user Personnel: A Survey of Knowledge and Skill Requirements." *MIS Quarterly*, 503-521.

Padgett, T. C., Beise, C. M., & Ganoe, Fred J. (1991). "Job Preparation of IS Graduates: Are They Ready for the Real World?" *Journal of Systems Management, 42(8),* 17.

Rogers, C., & Case, T. (1999). "A Preliminary Look at IS Job Listings on the Internet." *Proceedings of the 2nd Annual Conference of the Southern Association for Information Systems*, Atlanta, Georgia.

Rogers, C. F., Case, T. L., & Price, B.A. (1999). "The Information Systems Industry: Another Look at the Southeastern U. S." *Proceedings of the 14th Annual Conference of the International Academy for Information Management*, 373-382.

Todd, P. A., McKeen, J.D., & Gallupe, R. B. (1995). "The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements from 1970 to 1990." *MIS Quarterly*, 1-27.

Travis, J. E. (1996). "Meaningful Assessment." *The Clearing House, 69(5),* 308-313.

Weistroffer, H.R., & Gasen, J. B. (1995). "Assessment of Information Systems Programs: A Life Cycle Approach." *Journal of Education for Business*, 70(5), 258-263.

Wilson, L. (1996). "Annual Skills Survey: The Great Skills Chase. *Computerworld*, 87, 90, 93-94, 98.

Womble, M.N. (1994). "Graduates Assess Needed Skills and Knowledge for an Information Systems Program in a Small College." *Journal of Information Systems Education, 6(1),* 12-17.

Young, D., & Lee, S. (1997). "Corporate Hiring Criteria for IS Graduates." *Information Systems Management, 14(1),* 47-53.

APPENDIX A
Page 1

Information Systems
Senior Courses Survey
May 2000

Dear CISM Students:

As I hope that you know, the College of Business Administration at _______ University cares about its students and tries very hard to offer programs that are current and meeting the needs of its students as they prepare to move into careers and graduate school. In order to accomplish that goal, we need help from our current students and our alumni. This survey is being sent to each student enrolled in CISM 4xxx courses during Spring 2000 and a random sample of alumni who were graduated in 1998 and 1995. We plan to use the results as one component of an ongoing assessment of our program.

Please be assured that your responses will be handled confidentially by me. If you would prefer, you may print this survey, complete it by hand, and deliver it to me personally, to Ms. _______ or Mrs. ________ in the _______ Department Office, or via campus mail at P. O. Box____. Or, you may reply in this attachment and either attach it to an e-mail to me at _____ or drop it into the CISMSurvey Folder in my dropbox on the k drive using any anonymous filename you want.

However you reply, please do so by next Friday, May 12, 2000.

Thank you for your help and for being a part of our program.

Sincerely,

Chair, Department of_______________________________________

Please go to the next page.

APPENDIX A
Page 2

Below you will find a list of the courses which have been offered as part of the Information Systems curriculum during the past three years.

Semester Courses	Quarter Course Equivalents
CISM 3130 Applications Development	CIS 381 Introduction to Computer Programming
CISM 3134 Data Communications	CIS 484 Data Communications
CISM 3135 Systems Analysis and Design	CIS 384 Systems Analysis and Design
CISM 4134 Data Management	CIS 488 Applied Database Systems
CISM 4135 Project Management and Development	
CISM 4136 Global Information Resource Management	CIS 486 Information Resource Management
CISM 4234 Application Development with Objects	
CISM 4235 Application Development with COBOL	CIS 382 COBOL Programming
CISM 4236 AS/400 and Its Application	
CISM 4237 Decision Support Systems	
CISM 4238 Network Administration	

Please take a few moments to recall the courses from the list above which you completed during your time at GSU. Consider the content and the value of that content in preparing you for your future career.

Which course (content) contributed most to prepare you for your future in the IS field?

Which course (content) do you believe will be least valuable to you in your career?

In which course do you feel you learned the most?

Please go to the next (and last) page.

APPENDIX A
Page 3

List three to five strengths of the Information Systems Program:
(For example, internship opportunities, outside speakers, faculty, courses, equipment, laboratory hours, support staff, ... you tell us!)

List three to five weaknesses (Opportunities for Improvement) of the Information Systems Program:

Finally (and thanks for getting this far), please share anything else you feel that we should know about the Information Systems Program and, if you would like to add to your comments in the future, we always welcome your input.

Thanks.

TOWARDS A KNOWLEDGE MANAGEMENT MODEL FOR THE INFORMATION MANAGEMENT CURRICULA

Dennis Dunn
Manchester Metropolitan University

Ray Hackney
Manchester Metropolitan University

ABSTRACT

The growth of interest in all things 'knowledge management' (KM) is exponential. Developments of products and ideas, fuelled by a newly designated knowledge community, is happening at such speed that few seem to question the trends or the knowledge management systems finding favour in organizational life. A consideration of what is being presented as KM notes its remarkable similarity to the traditional features of 'information management' (IM) re-dressed in appearance but perhaps not the ideal starting point to get us to the desired destination. This paper identified these trends and develops prescriptions for the IM curricula. Most importantly it offers a critique of some of the issues that appear frequently absent in the teaching and learning of KM.

INTRODUCTION

Conceptually, KM itself may not be so very different from IM for it certainly appears to have some roots in organisational learning and in the concept of learning organizations. The advent of the Learning Organization (Argyris 1982, Senge 1990, De Geus 1997) or the Learning Company (Pedlar et al 1991) appears more than merely another management theory fad that promises unattainable benefit. In a review of these literatures one of the many disciplinary perspectives is management science with its ontology of information creation, capture, storage and dissemination. A role for the IM discipline in this endeavour is self-evident as is the development of supporting organisational infrastructure based upon information technology (IT) platforms and solutions. This disciplinary interest can also be tracked through Information Systems (IS) strategy literature in which surveys have consistently identified organisational learning as a key and strategic goal for the IT function. This goal has a recurring prominence over the last two decades. More recently a significant development within these literatures is focused around the concept of KM (Ranchhod and Hackney, 2000). Whilst KM is not a new theme, with its roots traced to the ancient Greeks, the contemporary opportunities afforded through IT developments would seem to open many previously incomprehensible pedagogic opportunities. Consequently, growth in interest in KM theory and practice is illustrated through the increasing prominence of the theme in the IM curricula. The increase in conferences, products and services are also being offered in support of the KM endeavour illustrates the probability of this theme being substantial and gaining much more significance than even its current highly visible status. These increases seem to coincide with a reported decline in the publication output around organisational learning. Indeed, during the 90's that decline in journal publications corresponds with an incline in those concerning KM. One interpretation of this might be that KM has become the current organisational learning theme. One has not replaced the other; rather they are part of the same genre. The currency of the KM theme though particularly strong and still strengthening might at some stage nonetheless be replaced by a yet more contemporary theme, though both still part of the organisational learning paradigm. Presently what we can observe is that the teaching and learning of KM is of such significance and interest that deeper pedagogic research is both warranted and worthwhile.

THE ROLE OF STUDENT INTRANETS

Intranet media designs offer support for traditional learning and, more critically, they augment the development of new ways of learning. This is to suggest that an Intranet provides the opportunity for different means of delivering information, different means of human-computer interaction and different means of creating appropriate environments for on-line learning. Clearly, there are a number of complex issues surrounding the achievement of these objectives which extend beyond a simplistic 'meet the needs of students' design. The available tools, including multimedia authoring software, Java integrated environments, common gateway interfaces, artificial intelligence, virtual reality modelling and language creation interaction techniques, all offer possible solutions. However, what is needed in this respect is a determination of the cognitive styles and preferences of the students in their interaction with an Intranet. Consequently, it may be possible to superimpose more general design principles onto the cognitive profiles of particular kinds of students. This should enable the better use of an on-line community for the realisation of an advanced learning experience (Hackney and Pagano, 2000).

Experience from KM could be viewed as a critical success factor in this respect for students who must continually learn if they are to survive in contemporary business (DeGues, 1997). Within these strategies it is clear that Intranets have a leading role for they pervade many areas of organizations and beyond to other elements of the supply chain (Miller and Dunn 1998). In particular, Intranets are increasingly expected to provide the knowledge dissemination infrastructure inter and intra organizationally, so as to support learning activities. Any comprehensive survey of the learning organization literature and practice quickly reveals the significance of KM for it is through the capturing of information and sharing of knowledge that organizations can be seen to learn (IPD, 1999). The inference is clear that for a successful teaching and learning strategy KM necessitates close attention to the issue of creating organizational knowledge and of its shared management. KM can be said to be the policies and processes through which organizations seek to create, store and disseminate organizational knowledge, and Intranets are fundamental to this endeavour (Dick and Burns, 1999). In this way the virtual environment can be understood to be a comprehensive knowledge system, as shown in Table 1.

TABLE 1
KM CURRICULA KNOWLEDGE SYSTEM (ADAPTED FROM ENDLAR, 2000)

	Teams	Technology	Learning
Trust	The building of positive team processes	Open and accessible information	Implicit knowledge made explicit through sharing of information
Conflict	Building relationships and mixing team talents	Open and instant communications for working with conflict	For deep levels of discussion and dialogue
Dialogue	A "core competency" for developing effectiveness and facilitating interaction	Enables a "higher order" of communication	Open and powerful communi-cation for moving beyond single understandings
Meetings	Helps motivate individuals while building relationships and "shared vision"	Asynchronous and synchronous meetings	Synchronised action without specific action plan
Electronic Practice Fields	Practice is performed in similar to work situations	Establishes real work environments for practice	Learning occurs through team processes without the fear of consequences
Technology Teams	Greater performance levels attained with teams using technology	Technology enables teaming processes of learning	Captured team knowledge results in learning for new team members and the organisation

Table 1
(continued)

	Teams	Technology	Learning
Virtual Teaming	Real life skills and new team skills for enhanced learning	Teaming without face-to-face contact	Continuous learning possible without waiting for next meeting
Networks	Develop team members	Enables instant access to information	Implicit knowledge made explicit through sharing of information between team
Groupware	Necessity for building relation-ships and bonding team members	Enables instant communication for dealing with conflict	Needed for reaching deep levels of discussion and dialogue
Collaboration	Team vision and focus for the team	User driven technological development enhanced	Learning opportunities from failure
Electronic Practice Fields	Practice is performed in similar to work situations	Establishes real work environments for practice	Learning occurs through team processes without the fear of consequences
Technology Teams	Greater performance levels attained with teams using technology	Technology enables teaming processes of learning	Captured team knowledge results in learning for new team members and the organisation
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Groupware	Necessity for building relation-ships and bonding team members	Enables instant communication for dealing with conflict	Needed for reaching deep levels of discussion and dialogue
Collaboration	Team vision and focus for the team	User driven technological development enhanced	Learning opportunities from failure
Team Learning	To align and develop teams to create results by challenging assumptions	Immediate and continuous dialogue and sharing work whilst apart	Collective intelligence that is greater than the some of individual intelligence's of the team members
Knowledge	Information transformed in knowledge	Tools for collaboration for capturing and storing knowledge	Greater learning leads to more knowledge in organisation
Implicit/ Explicit knowledge	To build learning teams implicit knowledge must become explicit knowledge	Sharing of knowledge increases transfer of implicit knowledge to explicit knowledge	Implicit knowledge made explicit and shared

Contemporary applications of KM systems therefore utilize Intranet as their principal tool. As one senior KM officer of a global top-six computer company recently asserted, "Our company wide Intranet is the window on the organizations knowledge". It is through this window that our students may learn about their increasingly virtual business world.

INFORMATION MANAGEMENT VS KNOWLEDGE MANAGEMENT TEACHING

There also appears considerable confusion, both in the literature and in organisational practice, between KM and IM. The two are often considered to be the same thing though it is clear that on more precise scrutiny they are not. If knowledge were the same as information then we would not need a different name in language to define it. Information and the data from which it is derived can be captured, stored and disseminated with relative ease and through commonly accepted practice. In effect, information is organisational history, codified and managed through information technology infrastructures amongst others. Conversely knowledge focuses not on history but on future. Knowledge creation is an outcome of human cognition that is unique to the individual and therefore inevitably influenced by phenomenology. Knowledge provides the capacity for individuals to take action, it is the 'know how' to information's 'know what'. Knowledge therefore cannot be captured in the same way as information nor managed accordingly. Indeed, knowledge cannot be managed at all, which means the term KM is regrettably misleading. Like many accepted and established labels in language KM is commercially expedient rather than accurately indicative of the endeavour itself. Even within the IM literature, knowledge is frequently positioned to follow information without the recognition that the two are in different domains, one retrospective, and the other futuristic. Understanding organisational knowledge might mean to understand how to bridge the gap between these two domains. This 'continuum' between organizational information and organizational knowledge appears previously to have received little discernable attention.

It is useful, therefore, to identify two critical curriculum issues for students of KM;

1. KM issues remain largely ambiguous or misunderstood with different organisational responses in evidence. Practice is as varied as organizations definitions. One of the few common responses, particularly amongst large organisations, appears substantial commitment in resource terms to the issue. KM products are flourishing; KM people are being appointed, sometimes at very senior levels (CKO's). Spending on KM appears to be taking an increasing proportion of IS organisational budgets. From all of these investments in time, people and systems, expected and anticipated paybacks will be substantial. Vendors offering KM solutions are likely to gain considerably in the next decade, perhaps more profitably than their clients in whose organizations their solutions will be deployed. IS strategy responses to KM appear largely to be around creating knowledge repositories (databases) and groupware applications, typically Lotus Notes and Intranets.

2. Discussion around knowledge capture, codification and dissemination too often simply mirrors the process of information management. The issue that in fact knowledge might not be capturable at all seems to be largely overlooked or ignored by many organisations. Further, that knowledge is not manageable like other organizational assets appears outside the realisation mindset of many. Distinct from the IM field, the human resource management (HRM) response to KM appears largely to be concerned with employee retention as a means of retaining knowledge. In an area of declining employment longevity and in which careers are now largely a series of consecutive steps between organisations, rather than within the same organisation, such strategy has limited and perhaps unrealistic value. Neither the IM nor the HRM functions seem to have yet developed an adequate strategic response to KM. The IPD have recently expressed this in terms of wishing KM to be perceived as an HRM issue for organisations whilst recognising the IT function is largely responsible for developing it and thus far maintaining the high ground. It appears time for new thinking around these issues, for neither IM nor HRM are likely to adequately respond to KM from their relative positions of isolation.

CONTEMPORARY CURRICULUM ISSUES

Contemporary KM feels intuitively almost a new issue; such is the interest and enthusiasm surrounding its apparent potential. KM promises opportunity not previously so well developed in organisational life. The facilitator of this opportunity is undoubtedly IT and within that, developments in communications technologies and software applications. However, the value added is predominantly to its people who learn, and use that learning to operate more effectively both as individuals and in their capacity to assist others within the organization. Consequently, within these issues, most notably organisational culture seems to make the significant difference between success and failure in KM endeavour. We can work with knowledge but not manage it, though we can to some extent manage the environment, manage the people and manage other organisational factors. In doing so we stay consistent with an aspiration to build a quality learning environment.

From teaching practice, four generic strategies can be discerned from reported KM endeavours (adapted from Prusak, 2000).

1. **Knowledge replication** i.e. banks, fast food chains, retailers e.g. Toys 'r' Us, MacDonald's, INTEL etc, all provide examples of conducting operations in precisely the same way wherever they are located world wide.

2. **Knowledge diffusion/leveragability** is about "knowing what we know, and using it". This seems to be the key strategy in most KM endeavours.

3. **Knowledge innovation,** which is concerned with knowing what comes next e.g. new products, new services, new ideas that might keep an organisation competitive.

4. **Knowledge commercialisation,** which is concerned with what does the organisation know that it can sell, i.e.. Consultancy, products and services, e.g. British Gas plc have developed KM systems initially for their own organisational needs but which they now seek to promote externally.

Of these generic strategies, knowledge diffusion appears the most prolific. However, organisations probably pursue more than one, perhaps sometimes all of these strategies simultaneously. By way of illustration a pharmaceutical company might be interested in strategies 1, 2 and 3 whilst a consulting group might focus on strategies 2 and 4. By segmenting the KM issue against differing strategic intention our curricular might develop a clearer perspective on the real contribution of KM. Strategically, we could be optimistic and feel that KM might afford our students the opportunity of acquiring competence towards competitive advantage. Realistically, we can predict with greater certainty that an inadequate teaching of KM will almost certainly leave individuals with a competitive disadvantage.

CONCLUSION

KM presents a different set of organisational challenges and appears to push the IM paradigm boundary sufficiently to require a different epistemological perspective. Participation in student group activities and events supports the articulation and use of tacit knowledge can never be captured or codified even if organisations had unlimited resources in which to make the attempt. Communities of people, networks and groups can share practice, knowledge and experience, which then become embedded in organisational routines and ultimately enculture the organisation. KM therefore may very well present new forms of organisational opportunity in the future. Taking the time to debate the more difficult aspects of KM might slow down the adoption of a KM façade. Whilst this might have short term unpopularity amongst vendors selling KM 'solutions' the long term benefits associated with breaking new ground, delivering the promise and potential of leveraging organizational knowledge, might be significantly rewarding for our students.

REFERENCES

Argyris, C. (1982). *Reasoning, Learning and Action*. Jossey-Bass. San Francisco.

De Geus, A. (1997). *The Living Company*. Harvard Business School Press, Boston.

Dick, G N and Burn, O M (1999) "Perceptions of the Internet: how important is who you are and what you know?" *Proceedings of IAIM*, Charlotte, USA, December

Endlar, L (2000) "Towards an Approach for Introducing Intranets for Supporting Team Learning," *Proceedings of BITWorld2000*, Santa Fe, Mexico, June

Hackney, R A and Pagano, R (2000) "Intranet Design: BIT student cognitive preferences," *Proceedings of Systems Integration 2000*, Prague, June

IPD (1999). "Knowledge Management: A Literature Review," *Institute of Personnel Development*, London.

Miller, K. Dunn, D. (1998). "Using Past Performance to Improve Future Practice: A Framework for Method Evaluation and Improvement." *ISD98 Seventh International Conference*. Bled. Slovenia

Pedler, M., Burgoyne, J. and Boydell, T. (1991). *The Learning Company: A Strategy for Sustainable Development*. London, McGraw-Hill.

Prusak L (2000) *IT Directors Forum Meeting*. Cranfield University. UK

Ranchhod, A and Hackney R A (2000) "Managing the IT Function: Furthering In-house Knowledge Elicitation," *Proceedings of IRMA2000*, Anchorage, Alaska, May

Senge, P.M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization.* Century Business: London.

TEACHING INFORMATION SYSTEMS AND INTERNATIONAL STUDENTS: A QUALITATIVE EXAMINATION OF THE CULTURAL DIFFERENCES IN COMPUTER SUPPORTED GROUP WORK

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ABSTRACT

This study explored the Impact of group technologies on student group work. The study focused on the differences on the impact of Group Support Technologies between students from two different national cultures. Groups of students from Australia and Malaysia participated in a series of GSS supported experiments using an unstructured task. There were four to five members in each group. Qualitative analysis of their comments showed that there were differences between groups from the two national cultures in the values they referred to in decision making process and further differences between the groups when they moved from ordinary group work to computer supported groupwork. In addition these differences were not alike for the groups from the two nations. The use of GSS technologies caused comments to be closer to the stated individual values by the participants.

INTRODUCTION

Rapid developments in information technology (IT) have generated potential changes to teaching and learning. In particular, technology-mediated learning which is the type of learning which involves implementation of information, computing, and communications technology applications (Alavi, Wheeler, & Valacich, 1995) in more than one location.

Technology-mediated learning of subjects is becoming an important option within IS education because it facilitates the sharing of costs, information, and expertise among multiple sites. Another advantage of using information technology in education is that students are introduced to and take advantage of the very technologies that businesses are using to gain competitive advantage (Leidner & Jarvenpaa, 1993). Most of the schools are under increased pressure to graduate students with experience with these emerging technologies (Alavi et al., 1995, Webster & Hackley, 1997).

Most of the information systems subjects in different schools provide access to different types of technologies to facilitate on-line groupwork. These might be as simple as a shared whiteboard, chat room or as sophisticated as the group decision support systems technologies. Some of these technologies can be set up in such a way to provide the students with complete anonymity. While for submitting a comment, some of the work group technologies require turn taking the others provide simultaneous entry of comments. In some cases lecturer/moderator can arrange a time for all of the students to be present on-line for the discussion while in other cases the discussion can take place not only at different places but also at different times.

Little research has addressed the impact of these technologies on students group work. As Leidner and Jarvenpaa (1993) and Alavi and colleagues (1995) outlined in their reviews of the learning literature, learning is best accomplished through the active involvement of students. The degree and the quality of student involvement in a decision making situation, according to the past cultural studies, depend on their cultural values (Yates & Lee, 1996).

The present study is an attempt to examine the interplay among cultural values, technology and the group work processes. The present study reviews the past cultural studies (eg, Hofstede, 1980; Schwartz & Bilsky, 1987; Schwartz, 1992), reports on a cultural survey and a series of quasi laboratory experiments. The attempt is to find a model for student groupwork based on their cultural values.

PAST CULTURAL STUDIES

Triandis (1994) believes that culture is to society what memory is to individuals. He believes that culture provides traditions that tell people what has worked in the past and makes it easy for humans to pick behaviours that may work again in the present Kluckhohn (1954) and later Triandis (1994) suggested that culture influences the way humans select, interpret, process, and use information. It is suggested by many cross-cultural researchers that culture includes systems of values (e.g., Hofstede, 1980; Mead, 1994). Cultural values are passed on by other members of the culture group, and become second nature and massively influence the individual's behaviour (Berry et al., 1992). They determine how the individual interprets the context of events; what is selected as important in a context, what needs to be explained and what can be taken as routine, or edited out of consciousness as insignificant.

Hofstede (1980) defines culture as 'the collective programming of the mind which distinguishes the members of one category from the other'. As Hodgetts et al. (1994) state "Culture can affect technology transfer, managerial attitudes, managerial ideology.... and how people think and behave.'

Some researchers have tried to provide a complete picture of national culture by dividing the culture into its subgroups and call them cultural dimensions. As Triandis (1994) states this is a valid way of *unpacking* culture to make it measurable. Hofstede suggested three cultural dimensions Power Distance, Uncertainty Avoidance and Individualism. He later extracted Masculinity/Femininity out of Individualism. Although his work has been recognised as a major cross-cultural work, the findings belong to two decades ago and there seems to be no simple way to tie his findings to any organisational activity.

Hofstede

Through what Hofstede (1980) called an *ecological factor analysis* of 32 mean scores for each of the 40 countries he identified three cultural dimensions, one of which was further split into two components, producing four dimensions altogether. Hofstede concluded that together these four dimensions explain half of the differences in mean value scores among his sample of 40 national cultures.

The labels Hofstede (1980) selected for the four dimensions together with their interpretations are as follows:

- *Power Distance*: Hofstede (1980) defines 'Power Distance' as '... the extent to which the less powerful members of institutions and organisations accept that power is distributed unequally'. Power distance refers to the extent to which unequal distribution of power in institutions and organisations is accepted by members of a society.

- *Uncertainty Avoidance*: The extent to which members of a society feel threatened by uncertainty is called 'Uncertainty Avoidance' (Hofstede, 1980).

- *Individualism/Collectivism*: Hofstede (1980) defines individualism as the relationship between the individual and the collectivity which prevails in a given society.

- *Masculinity versus Femininity*: Hofstede (1980) states that the predominant socialisation pattern is for men to be more assertive and for women to be more nurturing. His review of the work goals indicated a near consistency on men scoring advancement and earnings as more important, and women scoring supervision, social aspects of the job, working conditions, working hours and ease of work as more important (Hofstede, 1980). Hofstede's calculated scores of Masculinity/

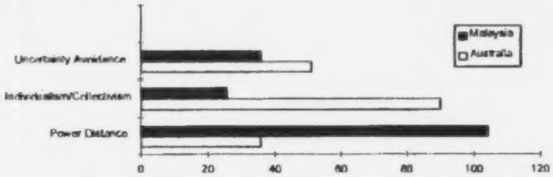
Femininity for only a small group of nations are available, and for this reason they are not included in Table 1 and Diagram 1.

TABLE 1
HOFSTEDE'S RANKS FOR MALAYSIA AND AUSTRALIA IN HIS 52-NATION STUDY

Country	Power Distance	Individualism/ Collectivism	Uncertainty Avoidance
	Rank	Rank	Rank
Australia	41	2	37
Malaysia	1	36	46

Table 1 shows the rank allocated to Australia and Malaysia based on Hofstede's calculated scores in comparison with the rest of his sample of national cultures. Diagram 1 shows the actual calculated scores based on the relative importance (the X axis) for these two national cultures assigned to the three cultural factors (the Y axis) by participants from Australia and Malaysia.

DIAGRAM 1
3 CULTURAL FACTORS SUGGESTED BY HOFSTEDE (1980) FOR THE TWO PARTICIPATING NATIONS



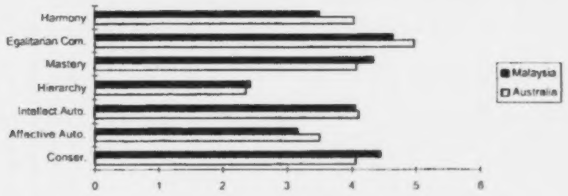
Schwartz and Bilsky

Schwartz and his colleague suggested seven cultural factors based on a list of 45 values (Schwartz & Bilsky, 1987; Schwartz, 1992). For each of the samples, the mean importance rating of each of these values was computed. Instead of any statistical method a diagrammatic method called S*mallest Space Analysis* (SSA, suggested by Gauttman, 1968) was used to find the cultural factors and their related values. The seven factors suggested by Schwartz and Bilsky are as follows:

- *Conservatism:* These are values likely to be important in societies based on close-knit harmonious relations, in which the interests of the person are not viewed as distinct from those of the group. Conservatism values are primarily concerned with security, conformity, and tradition.
- *Intellectual and Affective autonomy (Two Factors):* These are the values likely to be important in societies that view the person as an autonomous entity entitled to pursue his or her individual interests and desires. Schwartz (1994) distinguishes between two different types of Autonomy values: a more intellectual emphasis on self-direction and a more affective emphasis on stimulation and hedonism.
- *Hierarchy:* It is suggested by Schwartz (1994) that the preference for Hierarchy emerges closer to conservatism. The value 'humble' falls in this region. This location of humble reinforces the interpretation of the culture-level hierarchy value type as emphasising the legitimacy of hierarchical role and resource allocation.
- *Mastery:* Mastery values promote active efforts to modify one's surroundings and get ahead of other people, whereas Intellectual Autonomy values emphasise flexibility of thought and feeling but not active social behaviour. All the Mastery and Autonomous values, and some of the Hierarchy values, presume the acceptance of the individual's pursuit of personal interests as legitimate.
- *Egalitarian commitment:* These are values that express transcendence of selfish interests and are a social commitment that can occur in among equals. Schwartz believes that these values must be present in societies of autonomous individuals to function smoothly.
- *Harmony:* These values are suggested by Schwartz (1994) to emphasise harmony with nature and are supposed to be opposite Mastery (it is also stated earlier by Kluckhohn and Strodtbeck, 1961). Harmony values presume no particular stance regarding the autonomy of the person, but they stand in opposition to value types that promote actively changing the world through self-assertion and exploitation of people and resources.

The seven factors and their relative importance for participants of Australia and Malaysia in Schwartz et al. Study are represented in Diagram 2. In this diagram the 'X' axis shows the relative importance of each of the seven cultural factors and the 'Y' axis identifies each of the seven cultural factors.

DIAGRAM 2
SCHWARTZ & BILSKY'S 7-FACTOR MODEL FOR AUSTRALIA AND MALAYSIA



A possible relationship between the concepts of Hofstede, and Schwartz is presented in table 2.

TABLE 2
SUGGESTED EQUIVALENCE BETWEEN HOFSTEDE AND SCHWARTZ

Hofstede	Schwartz
Individualism	Affective individualism
Collectivism	Collectivism
High Power Distance	Hierarchy
Low Power Distance	Social Concern
Low Uncertainty Avoidance	Intellectual Individualism
Masculinity	Mastery
Femininity	Harmony

Cross-Cultural Studies of Decision-Making

The complexity of internal and external environments for the contemporary organisations calls for group decision making. Most organisations utilise groups, such as committees, task forces, teams, and other types of groups, rather than individuals, to make important decisions. March and Simon (1958), described the limitations in the individual's inherent capabilities of comprehending and comparing more than a few alternatives at a time as *bounded rationality*. It seems to be reasonable to expect that a group of knowledgeable individuals with diverse managerial and technical expertise will arrive at more effective decisions than an individual.

One of the reasons for the decision making research to be difficult has been claimed by Yates and Lee (1996) to be demonstrated in the phrase 'favourable outcome'. What is considered to be as favourable by one national culture would not be necessarily considered as such for another culture.

Plous (1993) claimed that what any decision-maker 'sees' as significant can differ markedly from what another regards as significant. It is not only the end result, the decision outcome, which can be perceived differently by different people, even the representation of the problem to be decided is different for different decision makers. Yates and Lee (1996) define a 'representation' as the decision-maker's personal characterisation of the given situation. It specifies what is taken into account by the decision-maker, and what is ignored. Representations are based on values, which differ in important ways (Schwartz, 1992). For example, there are cultures where 'tradition' and honouring parents and elders are much more important values than 'pleasure' or an 'exciting life'. Values work as filters for processing the information received and also shape what Triandis (1994) called the 'glasses through which we see the world' or what Plous (1994) called 'frame of mind', against which different alternatives are judged.

In different attempts at defining decision making, authors have suggested different lists of decision making processes (e.g., Boulding, 1975; Janis and Mann, 1977). All these processes including 'representation' and evaluation of different alternatives are readily influenced by innumerable conditions, including the abstract concept 'culture' (Plous, 1994; Yates and Lee, 1996).

One of the most important limitations of past decision-making research is that it lacks a cross-cultural orientation. Most decision research is conducted in North America and Europe. Relatively few empirical research studies have been conducted on how the rest of the world makes decisions, and as a consequence, it is hard to determine how universal are certain findings (Fletcher & Ward, 1988). The following examples illustrate the difficulty of drawing firm conclusions:

- Taylor and Jaggi (1974) found that Hindu Indians displayed attribution biases similar to those found in the United States, but other researchers have found differences in attribution style between Americans and Indians. In contrast to Americans who are prone to the 'fundamental' attribution error, Indians attribute behaviour to situational causes more often than dispositional causes (Miller, 1984).

- Stoner (1968) reported that risky shifts had been documented among American, British, and Israeli subjects, but other researchers have found differences in how American, British, and Asian subjects think about probability (Wright et al, 1978; Yates et al, 1989).

- Amir (1984) found that the Asch paradigm produced conformity levels in Kuwait comparable to those found in the United States, but Matsuda (1985) found higher levels of conformity in Japan than in United States. Thus findings that appeared general one year became culture-bound the next year.

- Research also suggests that Japanese subjects do not exhibit self-serving biases in attribution, unlike subjects from the United States, India, South Africa, and Yugoslavia (Chandler, Shama, Wolf, & Planchard, 1981).

- Two recent studies have revealed large differences in the apparent decision styles of Chinese and non-Chinese; differences that warrant attention. In one study, Zhang (1992) made a comparison of university students in Mainland China and in the United Kingdom. In the other, by Furnham and Stringfield (1993), the styles of Hong Kong Chinese and European employees of an airline company were contrasted.

- In their experiment, Yates et al (1992) presented Taiwanese Chinese, Japanese, and American subjects with general knowledge questions. They discovered that the Chinese subjects were more over-confident in their chosen answers because, quite literally, they saw fewer reasons why those answers might be wrong.

In the past two sections the literature on cross-cultural studies of values and decision making were reviewed. The following points were established:

1. In view of the growing globalisation there is a need to revisit some of the old theories and examine their applicability to different national cultures. These would include small group theories and group decision-making.

2. At individual level, Hofstede found Australia to have the second highest individualism and Malaysia to have the highest power distance.

THE PRESENT STUDY

Stage One — A Value Survey

Two hundred and eight first year undergraduate students responded to a 64-question questionnaire. The 64-question questionnaire was a self-administered instrument, designed to collect data on different cultural values. In addition, the questionnaire provided demographic characteristics of the population surveyed (For a detailed description of the questionnaire and the Factor analysis see Rahmati, 1998). All of the useable answers to the questions were subjected to factor analysis. Factor analysis grouped questions from the questionnaire as related to each factor. The name of the factors was decided upon based on the types of questions factor analysis had associated with each factor.

In order to investigate differences in value system between the two cultures the factors revealed in the factor analysis were used to compare the responses by national culture to the questionnaires. The mean values of the responses to related questions were used to calculate an overall mean for each factor. After finding the values for factors, their values for the two different national cultures involved in this study were compared. The statistical test selected to examine the differences between the two national groups was the Multivariate Analysis of Variance (MANOVA).

Results

Some of the nine cultural factors are similar in names with those of Hofstede's but they are different in the type of their relevant values. A brief description of each of these factors is presented below.

1. *The Religious Commitment Factor*: This is the relation of an individual to any ideological system, in this case a religious system, and it admits of different dimensions or types of variation; the individual's acceptance or rejection of the beliefs of the system (*Orthodoxy)*, his or her orientation toward other persons with respect to his or her beliefs (*Fanaticism)*, and the significance of their beliefs to their self-conception (*Importance*) are just some of these dimensions.

2. *The Workplace Preferences Factor*: The workplace items were adopted from the Hofstede's Hermes study and were actually a part of 14 work goal questions which were used by Hofstede to measure

for the individualism/collectivism index. The response to these questions should show the degree of importance associated with each case by the participant.

3. *The Locus of Control Factor*: The variables in this factor are related to the tendency of the individual to be in control of his or her own life. The locus of control was first developed by Rotter (1966) and numerous versions of the original locus of control have been validated and used in different studies (although not used in cross-cultural studies).

4. *The Fatalism Factor*: The variables in this factor are all related to the degree that the individual believes that the good or bad in his or her life is predestined, and how much the individual believes that every occurrence in human existence comes to pass because it was fated to do so.

5. *The Traditionalism Factor*: The traditionalism items, which are related to the fifth factor of the overall factor analysis, are related to a kind of obedience, which although foreign to Western societies, is quite commonly expected in traditionalist societies. The traditionalism items are related to family (spouse, children and parents) and the work relations.

6. *The Challenge and Adventure Factor*: The items on this factor, which is the sixth factor of the overall factor analysis, are more related to readiness to face challenge and adventure. Some of these items were included in Hofstede's measure of work goals in relation to individualism. The collection of items on this factor seems to be related to the individual, not necessarily related to work place characteristics. The loading of the items on this factor are more towards a belief by the individual in personal competence.

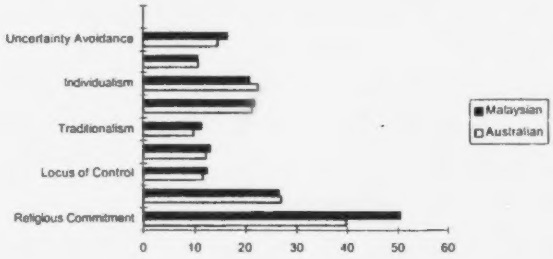
7. *The Individualism Factor*: The items on this factor are related to individualism. Some of the items are symbols of Competitive Individualism as defined by Triandis et al (1993). There are also items on this factor related to what Triandis et al define as 'Independence' as part of individualism.

8. *The Value of Privacy Factor*: The three items in this factor are very much related to the individualism value for privacy and the items are all positively related to the value of privacy factor. The value of privacy items are related to the individual's need for personal time and a personal set of friends in family life, and a valuing of the private opinion of the individual in the work place.

9. *The Uncertainty Avoidance Factor*: This factor is related to the different methods used by individuals to avoid uncertainty and to reduce the risk of unforeseen. Three items are related to sharing the risk with friends, and one item is related to choosing a large corporation over smaller ones to avoid the risk of losing a job. The last item is related to planning as yet another way to avoid the uncertainty of the future.

The multivariate analysis of variance for the above factors with nationality as the independent variable revealed a significant multivariate effect for nationality.

DIAGRAM 3
THE COMPARISON OF THE
SCORES CALCULATED FOR THE
TWO NATIONAL CULTURES BASED
ON THE NEW 9-FACTOR MODEL



Stage Two — Laboratory Quasi-experiments

Triandis (1994) mentioned the difficulty of ensuring that the same degree of manipulation of the independent variables has been used in each setting involving a cultural study. As a result it was decided to conduct the study using the same setting, that is to complete different parts of the study involving the two sets of national cultures in Australia instead of conducting the study in the two different countries involved.

The focus of this part of the study is on the value system referred to by the participants from the two nationalities in working with only one task used in groups. The details of the task and the qualitative analysis of the data can be seen in Rahmati (1998).

The groupwork of 95 participants, 50 Malaysian and 45 Australian participants was accepted for the purpose of this research. With the exception of one Australian group of four, all other groups had five members.

The resulting data from groupwork was a transcribed text of the tape recordings of the discussions of group sessions. This data was subjected to content analysis.

The method of content analysis followed an approach suggested by Morse and Field (1995). The researcher reads the entire document and identifies several of what they call 'topics'. These topics become the main categories or category labels. According to Berg (1995), the categories should be very broad at first to allow a large number of comments to be grouped into each category. Later these categories are divided into subcategories as the need arises. As different classes of comments (topics) emerged from the comments a diagram showing the relationship between different categories and subcategories in the data was developed. On the basis of the classification of categories in this diagram the codes were allocated to different classes of comments. The next step was to enter the data file and allocate the codes and develop the tree (the classification of comments) into Q.S.R. Nudist. The topics were selected based on their meaning and could be a part of a sentence, a complete sentence or even a paragraph, which would be allocated a code. The code would guide the software as to where the place of that special theme is compared to the rest of the tree.

Results

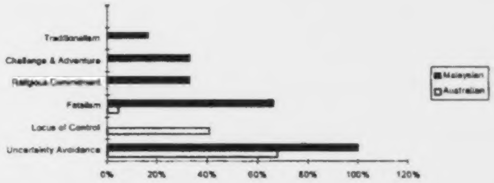
It was to be anticipated that not the values relevant to all factors would be referred to by groups of the two national cultures in each mode of decision-making situation. For the single task used in this study the participants referred to values relevant to 6 factors out of nine: Religious Commitment, Traditionalism, Locus of Control, Challenge and Adventure, and Fatalism. While the values of these six factors have been at work for this single task but the degree of their reference is different for different national groups.

There are some values related to some of the factors referred to by one set of national group that are missing from the list of factors referred to by the other one. These values and their relation to the factors are as follows:

Diagram 4 compares the reference made to the six cultural factors (Y-axis) by groups of the two national cultures. It should be noted that X-axis in this Diagram illustrates the relative frequency (percentage) of the groups, which have referred to the values of a factor. The diagram shows that no reference was made to any values relevant to Traditionalism, Challenge & Adventure, and Religious Commitment Factors by Australian participants. Malaysian participants made no reference to any values relevant to Internal Locus of Control.

Duty to God	**Religious Commitment**
Duty towards Country & Society	**Traditionalism**
Duty towards family	
Status	
The ability to make plans work	**Locus of Control**
Willingness to go to faraway places	**Challenge & Adventure**
The belief in luch and fate	**Fatalism**
The willingness to share the responsibility for any decision	**Uncertainty Avoidence**

DIAGRAM 4
THE COMPARISON BETWEEN THE CULTURAL VALUES REFERRED TO BY GROUPS FROM AUSTRALIA AND MALAYSIA



DISCUSSION

It was established that, facing the same decision-making problem in a similar decision-making environment, groups of the two different national cultures referred to different cultural factors and, based on these in some cases reached different decisions. It was also discovered that, in the cases where the two sets of national groups made similar decisions, their selection was based on different values.

The Australian participants who had high individualism, low traditionalism, and high internal locus of control were a clear example of a 'loose' society. According to Pelto (1968) and Triandis (1994) in a loose society the

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values relating to the formalisation of group behaviour are undeveloped because deviant behaviour is easily tolerated.

The comments made by Malaysian groups showed significantly higher uncertainty avoidance, religious commitment, and collectivism, than the Australian participants, as well as high traditionalism and external locus of control (Fatalism). Such a set of values would define Triandis's (1994) 'tight' society. The detailed cultural characteristics of groups from the two national cultures are examined below.

1. The high score for the Uncertainty Avoidance factor for the Malaysian students, found in this study, indicated a willingness to share the decision-making process in order to decrease the risks involved. The reason for this interpretation is that three of the five items of the Uncertainty factor are related to sharing the responsibility in a decision-making situation. Australian students showed considerably lower uncertainty avoidance, which is close to the findings of their value survey.

2. Triandis (1994) believed that groups in a collectivist society are the basic units of social perception. The high collectivism (or the low individualism) of the Malaysian participants would encourage group decision-making in any decision-making situation. A very low collectivism is a confirmation of the presence of high individualism for Australian students who believe that they are responsible for their own life.

3. The high traditionalism factor for the Malaysian groups suggested the existence of a set of social regulations for influencing any type of social interaction, including group interactions. This set of regulations includes a respect for seniors and people of high status in the group. Such social regulations could be considered as a restriction in terms of what would be considered proper behaviour by group members in aspects of group decision-making, such as turn taking, and willingness to disagree with the suggested alternative of their seniors. In Australia as a loose society, individuals are accepted for their own personal merits and not because of their seniority or the class or their family. There may be little reason for individuals as group members in such a society to hide their disagreement in a decision-making situation.

4. The strong rating accorded to an external locus of control (Fatalism) by the Malaysian participants suggests they may be more likely to engage in risk taking behaviour (Battle & Rotter, 1963), because there is a belief that any consequences would be the responsibility of the superior external forces. This contrasts with the high internal locus of control shown by Australian groups. With high internal locus of control the decision-makers believe that they are responsible for the consequences of their decision. As a result to reduce the risk of a bad decision, the decision-making groups discuss all aspects of each alternative in detail before making their final decision. In such situation group members need their own *air time* to discuss their points of view.

The sum of the above features results in a situation for the Malaysian participants in which, although collectivism and religious commitment encourage the tendency towards group decision-making, the adherence to high traditionalism results in some limitations in group interactions. Malaysian participants are likely to be significantly limited by their social rules concerning group interactions. These limitations may include being obliged to agree with their seniors and refraining from expressing their opinion in group sessions.

REFERENCES

Alavi, M., Wheeler, B. C., & Valacich, J. S. (1995). "Using IT to Reengineer Business Education: An Exploratory Investigation of Collaborative Telelearning." *MIS Quarterly*, 19: 293-312.

Amir, T. (1984). "The Asch Conformity Effects: A Study in Kuwait." *Social Behaviour and Personality* 12: 187-190.

Battle, E. S. and J. B. Rotter (1963). "Children's Feelings of Personal Control As Related to Social Class and Ethnic Group." *Journal of Personality* 34(482-490).

Beamish, P. W. and J. L. Calof (1989). "International Business Education: A Corporate View." *Journal of Business Studies* Fall: 553-64.

Berg, B. L. (1995). *Qualitative Research Methods for the Social Sciences*. Boston, MA, Allyn and Bacon.

Berry, J. W., Y. Poortinga, et al. (1992). *Cross-cultural Psychology*. New York, Cambridge Press.

Boulding, K. E. (1975). "Truth or Power?." *Science* 190(7).

Chandler, T. A., D. D. Shama, et al. (1981). "Multi-attributional Causality: A Five Cross-national Samples Study." *Journal of Cross Cultural Psychology* 12: 207-221.

Chesbrough, H. and D. J. Teece (1996). "When Is Virtual Virtuous? Organizing for Innovation." *Harvard Business Review* 1/1/96(96103).

Fletcher, G. J. O. and W. Ward (1988). *Attributional Theory and Processes: A Cross-cultural Perspective. The Cross-cultural Challenge to Social Psychology*. M. H. Bond. Newbury Park, CA, Sage Publications.

Furnham, A. and P. Stringfield (1993). "Personality and Work Performance: Myer-Briggs Type Indicator Correlates of Managerial Performance in Two Cultures." *Persoanlity and Individual Differences* 14: 145-153.

Guttman, L. (1968). "A General Nonmetric Technique for Finding the Smallest Coordinate for A Configuration of Points." *Psychometrica*.

Hodgetts, R. M. and F. Luthans (1994). *International Management*. New York, McGraw-Hill, Inc.

Hofstede, G. (1980). *Culture's Consequences International Differences in Work-Related Values*. Newbury Park, SAGE Publications, Inc.

Janis, I. L. and L. Mann (1977). *Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment*. New York, Free Press.

Kluckhohn, C. (1954). "Culture and Behavior." *Handbook of Social Psychology*.

G. Kluckhohn, F. R. and F. L. Strodtbeck (1961). *Variations in Value Orientations*. Evanston, IL, Row Peterson.

Leidner, D. E., & Jarvenpaa, S. L., (1993). "The Information Age Confronts Education: Case Studies on Electronic Classrooms." *Information Systems Research*, 4: 24-54.

March, J. G. and H. A. Simon (1958). *Organizations*. New York, Wiley.

Matsuda, N. (1985). "Strong, Quasi-, and Weeak Conformity Among Japanese in the Modified Asch Procedure." *Journal of Cross Cultural Psychology* 16: 83-97.

Mead, R. (1994). *International Management Cross-Cultural Dimensions*. Cambridge, Mass., Blackwell Publishers.

Miller, J. G. (1984). "Culture and the Development of Everyday Social Explanation." *Journal of Personality and Social Psychology* 46: 961-978.

Morse, J. M. and P. A. Field (1995). *Qualitative Research Methods for Health Professionals*. London, UK, Sage Publications.

Plous, S. (1993). *The Psychology of Judgement and Decision Making*, McGraw-Hill, Inc.

Rahmati, N. (1998). "A Two-Nation Study of GDSS and the Cultural Values Used in Decision-Making." School of Information Systems, Faculty of Business and Management. Adelaide, South Australia: 260.

Rotter, J. B. (1966). "Generalized Expectanciesfor Internal versus External Control of Reinforcement." *Psychological Monographs* 80(1).

Schwartz, S. H. and W. Bilsky (1987). "Toward a Universal Psychological Structure of Human Values." *Journal of personality and Social Psychology* 53(3): 550-562.

Schwartz, S. H. (1992). "Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries." *Advances in Experimental Social Psychology*. M. Zanna. Orlando, Fl., Academic Press. 25.

Schwartz, S. H. (1994). *Beyond Individualism/ Collectivism: New Cultural Dimensions of Values. Individualism and Collectivism: Theory, Method, and Applications*. U. Kim, H. C. Triandis, C. Kagitcibasi, S.C Choi and G. Yoon. Thousand Oaks, SAGE Publications. 18: 85-119.

Stoner, J. A. F. (1968). "Risky and Cautios Shifts in Group Decisions: The Influence of Widely Held Values." *Journal of Experimental Social Psychology* 4: 442-459.

Taylor, D. M. and V. Jaggi (1974). "Ethnocentrism and Causal Attribution in A South Indian Context." *Journal of Cross Cultural Psychology* 5: 162-171.

Triandis, H. C., H. Betancourt, et al. (1993). "An Etic-Emic Analysis of Individualism and Collectivism." *The Journal of Cross-Cultural Psychology* 24(No. 3, September): 366-383.

Triandis, H. C. (1994). *Culture and Social Behavior*. New York, McGraw-Hill.

Webster, J. & P. Hackley, (1997). "Teaching Effectiveness in Technology-mediated Distance Learning." *Academy of Management Journal*. 40, 6: 282.

Wright, G. N., L. D. Phillips, et al. (1978). "Cultural Differences in Probabilistic Thinking." *Journal of Cross-Cultural Psychology* 9: 285-292.

Yates, J. F. and J. W. Lee (1996). "Chinese Decision Making." *The Handbook of Chinese Psychology*. M. H. Bond. Hong Kong, Oxford University Press.

Yates, J. F., Y. Zhu, et al. (1989). "Probability Judgement Accuracy: China, Japan, and United States." *Organizational Behavior and Human Decision Processes* 43: 145-171.

Zhang, B. (1992). *Cultural Conditionality in Decision Making: A Prospect of Probabilistic Thinking*. Department of Information Systems. London, London School of Economics and Political Science, University of London.

RAPID CURRICULUM DEVELOPMENT: FAST-TRACK CREATION OF A SCHOOL OF INFORMATION TECHNOLOGY

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ABSTRACT

On April 2, 2000, Georgia Southern University's newly inaugurated President announced the creation of a School or College of Information Technology as a facet of the Governor's rural economic development initiatives. The new academic unit, scheduled to be implemented Fall Semester 2001, is tasked with at least tripling the university's annual production of IT undergraduates and will be housed in a new building. This paper will describe the steps taken to operationalize the newly announced academic unit with special emphasis on curricular issues. It summarizes key aspects of a white paper produced by an ad hoc College of Business Administration committee. The white paper documents the need for the new academic unit, identifies targeted industries, outlines a forward-thinking curriculum model, proposes degree programs, includes student and faculty projections, summarizes major facilities and resources needs, proposes the creation of an "eInstitute," and provides an overview of a preliminary marketing/promotion plan. As such, the white paper's format and content are valuable to other universities faced with the challenge/opportunity to rapidly expand their IS/IT programs.

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INTRODUCTION

On Sunday, April 2, 2000, Dr. Bruce Grube announced the creation of a school/college of Information Technology during his inaugural address as Georgia Southern University's newest President. He noted that the new academic unit was part of Georgia Governor Ray Barnes' "One Georgia (rural economic development). Dr. Grube also stated that $500,000 in planning money for the new school/college has been included in the state legislature's supplemental budget and that a new building to house the academic unit's programs had been placed on the Board of Regent's "super-fast-track construction list.

The rationale for this initiative began at the Governor's office. Georgia Governor Ray Barnes wants to create a statewide environment that will enable the New Economy to flourish. He is widely viewed among movers and shakers in the state's IT professional community as a governor who "gets it. For example, soon after taking office in 1999, Governor Barnes announced the Yamacraw Mission aimed at attracting high bandwidth communications expertise, companies and jobs to the state. Because an appropriately skilled workforce is essential for enticing high-tech firms to relocate or expand to the state, a key facet of the Yamacraw Mission is an increase of more than 40 faculty members in targeted disciplines at the Georgia Institute of Technology. The occupants of these new positions are tasked with significantly increasing the University System of Georgia's (USG) annual production of graduates with the skills needed by high bandwidth communications companies. Some of these faculty members would actually teach at other USG institutions through the Georgia Tech Regional Engineering Program (GTREP). Through GTREP, Georgia Southern University is home to Southeast Georgia's first computer engineering degree program.

Heeding private sector advice that the state should lead by example if it wants to attract e-business firms to the state, Governor Barnes has also promoted e-commerce applications among state agencies. In 1999, Georgia was recognized as leading the nation in government e-commerce applications.

The governor has also commissioned a number of studies to pinpoint IT work force needs across the state. In one report, *E-Commerce and the State of Georgia*, McLean, McDonald, and Case (1999) indicated that E-commerce activity was much more vigorous in the Atlanta metropolitan area than in most other parts of the state. The report recommended concerted efforts to leverage existing private sector and USG infrastructure strengths in other bright spots in the state including Columbus and Savannah. The creation of a school/college of Information Technology at Georgia Southern that is tasked with at least tripling it annual undergraduate output of IT majors will make the coastal region of Georgia (and the state as a whole) an attractive site for high-tech relocation and expansion.

Initial Reactions

Three days after the public announcement of the new school/college of IT, Carl Gooding, Dean of the College of Business administration met with the faculty of the Department of Information Systems and Logistics. The purpose of the meeting was to describe the genesis of the new initiative, his understanding of the process of that would be taking place at the university level, and his recommendations of for how the department and college should respond. Dean Gooding confirmed that this was a top-down initiative that originated at the governor's office. He noted that the Dean of the College of Technology had already drafted a short "white paper calling for the establishment of a College of Information Technology; he also noted that a preliminary program statement for the new building had been developed by another administrator. More importantly, the dean stated that President Grube felt that the College of Business Administration should drive the creation and implementation of the new academic unit even though degree programs outside the College of Business (such as computer science and geographic information systems and possibly computer engineering) would probably be directly or virtually related to the new school/college. Dean Gooding noted that the President had encouraged him to "be aggressive and that a School of IT within the College of Business seemed to be an appropriate first step toward what one day might evolve into an independent College of Information Technology.

Creation of the COBA Committee

At the meeting with the Department of Information Systems and Logistics, Dean Gooding announced that he would be appointing an ad hoc COBA committee composed primarily of IS faculty and representatives of other IT-oriented business disciplines including accounting information systems, logistics, and operations management. The director of the Center for Economic Development would be on the committee and representatives from other disciplines (including computer science and geography) would be invited to participate. The committee would be tasked to: a) immediately develop a "white paper summarizing COBA's recommendations for a School of Information Technology, and b) work with the soon to be appointed university-level steering committee on an ongoing basis to ensure that the new academic unit degree programs have an appropriate business and economic development orientation.

Over the next two days, the COBA committee was announced, charged, and began meeting several times a week. One of its first actions was to create a "white paper sub-committee composed of IS faculty members. In order to have a draft of a COBA white paper before an April 29 Business Advisory Council meeting, and before the appointment of the university-level committee, this committee began meeting on a daily basis.

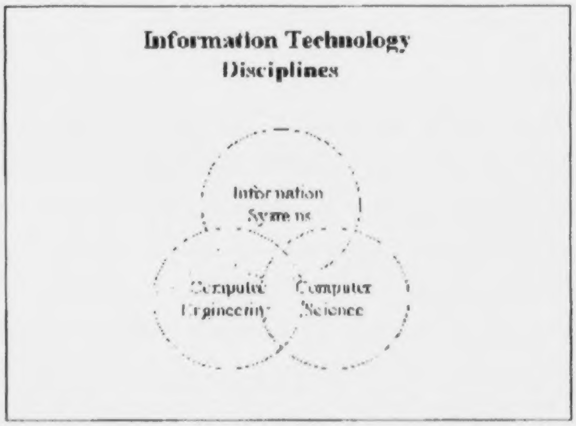
The White Paper Sub-Committee

Because COBA would have less than fifty percent of the seats on the university-level committee for the school/college of IT, wording in the white paper became a critical issues. While desiring to develop compelling arguments for establishing a School of Information Technology within COBA, the sub-committee recognized the value of being inclusive.

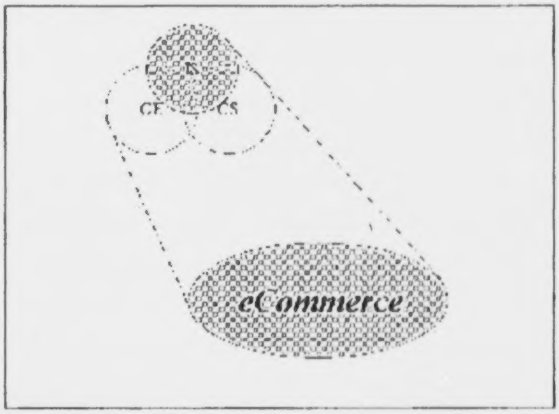
This sub-committee decided that one way to accomplish this was to maintain focus on the economic development aspects of the new academic unit. Emphasis would be placed on creating a readily available work force for attracting high technology firms to Southeast Georgia.

The sub-committee also chose to focus on the rapid evolution of IT is rapidly evolving and the difficulties that can be encountered when trying to delineate its boundaries. In order to connect readers to disciplines already in place at Georgia Southern, the white paper sub-committee chose to conceptualize IT as being grounded in the three disciplines depicted below.

The strength of an academic program in Information Technology accrues from the blending of concepts from these three areas. Traditionally, computer science programs provide rigorous grounding in computing theory, programming techniques, and algorithmic processes. Computer engineering programs address the research and development of digital circuitry and related systems that comprise the infrastructure of any computing environment. Information systems programs are more applied, emphasizing the integration of fundamental programming principles, network administration, and database design to create business applications.



Across all three disciplines there is a need to address modern applications of IT which are increasingly reliant on the development and support of business strategies based on eCommerce. This may be illustrated in the following manner.



To ensure inclusiveness, the white paper sub-committee chose to define *eCommerce* in a very broad sense that draws from all areas of information technology. E-Commerce's primary goal is to meet the needs of business, government, and nonprofit organizations within an electronic environment. As a result, necessary theory should be integrated with the rigorous development of applied IT skills. These programs should

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address specific industry needs and support the overall economic health of the region, state, and nation.

DOCUMENTING THE NEED FOR MORE IT PROFESSIONALS

The sub-committee turned to several sources to establish the need more appropriately skilled IT workers in the region, state, and nation. Compelling evidence for national IT worker shortages came from a recent report issued by the Information Technology Association of America (ITAA) indicating that 1 in 12 IS/IT jobs in the U.S. are currently vacant. This report also indicates that more than one half of the 1.6 million new IT jobs created this year are likely to go unfilled (see: http://www.itaa.org/workforce/studies/hw00execsumm.htm). The ITAA findings are consistent with those in reports issued by the U.S. Department of Commerce (e.g., *The Digital Work Force: Building Infotech Skills at the Speed of Innovation*, July 1999).

Further support for IT work force increases at the national level is provided by *The Emerging Digital Economy* (http://www.commerce.gov/ede/report.html), the Department of Commerce predicts that by 2006, almost one half, or 49 percent, of the private work force will be employed either by IT-producing companies (manufacturers/providers of IT equipment or services) or firms that are heavy users if IT. In 2006, the work force of IT-producers is expected to exceed 6 million while the work force of heavy IT-users will grow to more than 51 million. Annual work force increases in IT-producing industries are expected to range between 7 and 8 percent between now and 2006. Similar annual increases are expected in IS/IT positions in heavy IT-using firms. In IT-producing industries, software and services are generating the largest demand for new workers; significantly smaller gains are expected in firms that manufacture computer hardware or communications equipment.

The sub-committee also summarized the findings of studies indicating rapid growth in Georgia's IT work force as well as growing IS/IT worker shortages. For example, *Electronic Commerce and the State of Georgia* (www.icapp.org/pubs/index.html) reports that more than 5,500 new “core IT jobs, i.e., computer scientists, computer engineers, systems engineers, computer programmers, will be needed annually in the state until 2006. This is presented in detail in the following table.

McLean and McDonald (2000) and Chaker (2000) also report that Georgia leads the Southeast in the growth of IT workers and is second nationally in such growth. The following table illustrates this growth.

CORE IT JOBS IN GEORGIA, 1996-2006

Occupational Title	1996 Employment	2006 Employment	Total Change	Percent Change	Average Annual Openings
Computer Scientists	6,000	16,200	10,200	171	1,080
Computer Engineers	4,400	11,300	6,900	156	720
Systems Analysts	13,600	34,300	20,700	152	2160
Computer Programmers	18,750	28,950	10,200	54	1,600
Totals	42,750	90,750	48,050	112	5,560

(Source: *The Digital Workforce*, U.S. Department of Commerce, July 1999)

IMPORTANT IT LABOR MARKET STATISTICS FOR STATES IN THE SOUTH AND SOUTHEAST

State	No. of IT Workers Employed (Estimate for 2006)	Ranks		Fastest Growth % Increase 1996-2006	Ranks		Average Annual Job Openings 1996-2006	Ranks	
		Region	US		Region	US		Region	US
Alabama	31,000	4	19	64	3	20	1,730	4	18
Florida	95,400	1	7	63	4	23	4,620	2	9
Georgia	**90,750**	**2**	**9**	**112**	**1**	**2**	**5,560**	**1**	**5**
Mississippi	7,350	7	33	54	7	35	330	7	33
North Carolina	69,950	3	12	80	2	7	3,770	3	12
South Carolina	16,250	6	23	56	6	31	770	6	23
Tennessee	27,550	5	20	59	5	28	1,310	5	19

(Source: *The Digital Workforce*, U.S. Department of Commerce, July 1999)

Several other studies were used by the white paper sub-committee to reinforce the need for the new academic unit at Georgia Southern. For example, Burriss (1999) summarized the results of a indicating that as many as 1 in every 3 new IT positions in Georgia will go unfilled if steps are not taken by the state to increase the supply of appropriately skilled workers. If these needs are not addressed, the growth of Georgia's high technology sector will be slowed as will the growth of businesses that rely on IT.

Burriss (1999) also notes that while the University System of Georgia (the state's largest source of IS/IT graduates) has increased the number of degrees conferred each year of computer programmers, computer engineers, and systems analysts from 1996 to 1998, a tremendous gap between supply and demand still remains. Currently there are annual shortfalls of more than 1,350 in just these three IS/IT occupations. Total shortfalls will mushroom to more than 13,000 by 2005 if USG does not increase graduates in these areas.

In sum, data from numerous sources was used by the white paper sub-committee to document the growing demand for IS/IT workers as well as growing shortages of appropriately skilled workers. The findings suggest that the USG and Georgia Southern University will be better positioned to address regional, state, and national needs for IS/IT workers through the implementation of this new academic unit. The data also suggest that the creation of this academic unit will strengthen southeast Georgia's ability to attract firms that are producers of IT and firms that are heavy users of IT to this region. This is consistent with the rural economic development initiatives associated with the governor's "One Georgia initiative.

Targeted Industries

An important aspect of Governor Barnes' economic development initiative is focused on attracting and/or facilitating the expansion of firms that may be classified as IT-Producers or Heavy IT-Users. Examples of firms falling into these two categories are illustrated below:

IT Producing Organizations

Hardware Manufacturers
e.g., Dell, Intel, Sun, etc.

Software Developers
e.g., Microsoft, Oracle, SAP, JD Edwards, etc.

IT Infrastructure Developers
e.g., AT&T, MCI/WorldCom, Cisco, UUNET, etc.

Consulting Firms
e.g., IBM Global Services, EDS, answer*think*, KPMG, Anderson Consulting, etc.

Heavy IT User Organizations

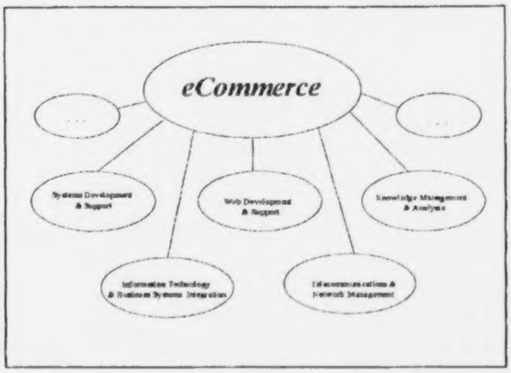
Retail
e.g., Wal-Mart, The Home Depot, Office Depot, Amazon.com, etc.
Service
e.g., UPS, Southern Company, BellSouth, American Express, Delta, AFLAC, Synovus, health care, etc.

Manufacturing
e.g., Coca-Cola, Ford, GM, Caterpillar, Briggs & Stratton, etc.

Firms that fall into these distinct categories will have unique requirements and needs for IT graduates. In order to support the governor's economic development initiatives, the COBA committee felt that the School of Information Technology should have a curriculum capable of meeting as many of these diverse needs as possible. Toward this end, the COBA committee recommended the solicitation of direct input from multiple firms in each category as well as the creation of an advisory board comprised of representatives from firms in each category to guide, direct, and update the curriculum. The COBA committee also recommended soliciting ongoing input from Georgia Southern University's alumni who work in the IT field.

CONCEPTUAL MODEL FOR A CURRICULUM TO ADDRESS THE WORK FORCE NEEDS OF TARGETED INDUSTRIES

In order to develop a sufficiently diverse curriculum to meet the work force needs of targeted industries, COBA's white paper subcommittee recommended a conceptual curriculum model composed of an eCommerce core and multiple sub-discipline specializations or 'pods'. Each of these is considered to be dynamic and is expected to continue to evolve. The initial conceptual model calls for five distinct "pods designed to meet specific skill shortages in the targeted industries. These pods are illustrated and discussed more fully below:


eCommerce
...
...
Systems Development & Support
Web Development & Support
Knowledge Management & Analysis
Information Technology & Business Systems Integration
Telecommunications & Network Management

Systems Development and Support

The Systems Development and Support pod is proposed to address the business and industry need to develop and deliver core business applications, i.e., accounting, manufacturing, marketing, logistics, etc. This pod includes the development of applications using both traditional and object-oriented (a new programming methodology in which objects are built and manipulated) approaches. It will support legacy (old, traditional) systems as well as current online transaction processing (OLTP) systems. Integrated into this sub-discipline will be fundamentals of languages, systems analysis and design, data management, and data communications. Graduates will be prepared for positions with companies where IT is the primary product or service the company is generating as well as with companies that are themselves heavy users of IT products and services.

Information Technology and Business Systems Integration

The proposed Information Technology and Business Systems Integration pod is designed to address the business and industry need to deliver integrated systems solutions. Primarily focused on consulting, implementation, training, and support, this pod will include the installation and integration of packaged (or previously developed) business applications solutions, i.e., Enterprise Resource Planning (ERP) systems, Customer Relationship Management (CRM) systems, and Supply Chain Management (SCM) systems. This pod will focus on systems analysis and design, systems implementation, project management, and decision analysis. Fundamental concepts of languages, data management, and data communications will be incorporated into this area of study. Graduates will be prepared for positions with companies that deliver IT products and services requiring systems consultants, implementers, trainers, and problem resolution specialists.

Web Development and Support

The Web Development and Support pod is designed to address the business and industry need to develop and deliver web-based applications. Primarily targeting web-based and web-enabled systems, this pod will include the development of applications using an object-oriented approach with web languages (i.e., Java, HTML, DHTML, XML, Perl), data management (CGI, database interface/integration), and network management. Key areas of emphasis include user interface design, graphics design, and electronic publishing. Fundamental concepts of systems analysis and design, systems implementation, and project management will be included in this area of study. Graduates will be prepared for positions with companies in which the IT product or service requires web development and support skills, as well as with companies that are heavy users of web-based IT products and services.

Telecommunications/Network Specialist

The Telecommunications/Network Specialist area of study will address the business and industry needs to develop and support telecommunications networks. This pod will include the design, development, implementation, and management of organizational networks, including local area networks (LAN) and wide area networks (WAN). Key areas of emphasis will be user network analysis and design, internet/intranet/extranet development, electronic data interchange (EDI), and network management. Fundamental concepts of languages, data management, and project management will be included. Graduates will be prepared for positions with companies that offer an IT product or service which requires telecommunications networks and with companies that are heavy users of IT telecommunications network products and services.

Knowledge Management and Analysis Specialist

The Knowledge Management and Analysis Specialist pod will address the business and industry need to design, implement, and analyze enterprise (collected from the entire organization) data. This pod will include the design, development, implementation, and management of enterprise data warehouses and vision based analytical systems, i.e., geographic information

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systems (GIS). Key areas of emphasis would be decision analysis, online analytical processing (OLAP), data mining, and spatial data modeling and analysis. Fundamental concepts of data management, database, and programming languages will be included. These graduates will be sought by companies in which IT is the product or service as well as with companies that are heavy users of IT products and services requiring intense data collection, storage, and analysis with a focus on improving organizational decision making.

Proposed Degree Models

Because the School of Information Technology is on a fast-track implementation schedule, the COBA committee recommended leveraging existing IS courses as much as possible in the new academic unit's curriculum. The current BBA/IS curriculum at Georgia Southern includes the following IS courses:

☆	CISM 2130	Computers and Applications
☆	CSCI 1236	Introduction to Java
☆	CISM 3130	Application Development (in Java)
☆	CISM 3134	Business Data Communications
☆	CISM 3135	Systems Development
☆	CISM 4134	Database Applications
☆	CISM 4135	Project Management
☆	CISM 4136	Global Information Resource Management
☆	Two CISM electives (most commonly CISM 4236 Decision Support Systems; CISM 4247 Object Oriented Programming; CISM 4238 Network Administration)	

The current curriculum provides also hands-on experience with a variety of languages and software packages including HTML, Java, Visual Basic, MS Office, MS Project, Designer 2000, Developer 2000, NetWare 5, Windows 95/98 and Windows 2000.

The COBA committee also recommended that all degree programs in the School of IT should include at least a minor in business. This would help to ensure that graduates of the School of IT possess an appropriate grounding in business in addition to a technical focus.

In response, the white paper sub-committee proposed to ensure a technical focus by requiring majors in any COBA-controlled degree program to take multiple courses in at least one of the pods. This committee also proposed two COBA-controlled degree options within the School of Information Technology. Both would leverage existing business and IS courses and would achieve the appropriate technical focus needed by targeted industries via courses in one or more of the pods identified in the conceptual model.

The BBA/IS degree would continue to provide students with a strong business orientation, but would enable students to gain additional technical skills associated with a particular pod. The proposed BS/IT degree would allow students to pursue a business-oriented degree while gaining technical skills associated with two pods. The two degree programs are outlined below:

BBA in Information Systems	**Bachelor of Science in IT**
8 courses constitute BBA core	4 courses constitute business minor
7 courses in major: 4 courses constitute 'IS core' 1 pod, consisting of 3 courses	12 courses in major: 6 courses constitute 'IT core' 2 pods, each consisting of 3 courses

Other degree programs within the School of Information could include current or proposed degrees in Applied Computer Science and/or Computer Engineering. If the new academic unit is housed within COBA, the students enrolled in these degree programs would be encouraged (but not required) to pursue a minor in business. Only students enrolled in COBA-controlled degree programs (the BBA/IS and proposed BS/IT) within the School of Information Technology would be required to obtain at least a minor in business.

OTHER KEY ELEMENTS IN THE COBA WHITE PAPER

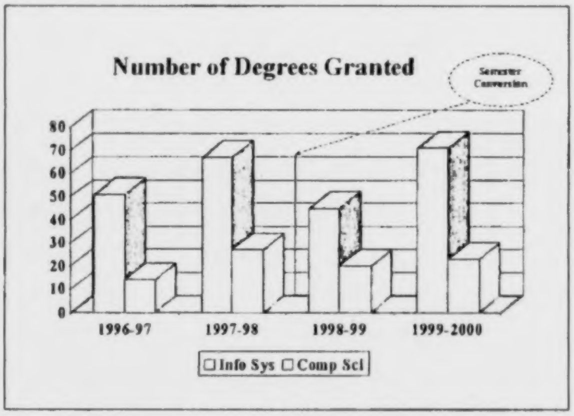
Beyond documenting the need for a School of IT and outlining a forward-looking curriculum model and degree programs, the COBA white paper included several key elements. The key elements include projected student enrollment, projected faculty needs, facility requirements, a proposal to create an eInstitute, and a preliminary marketing and recruiting plan. These are discussed in the following sections.

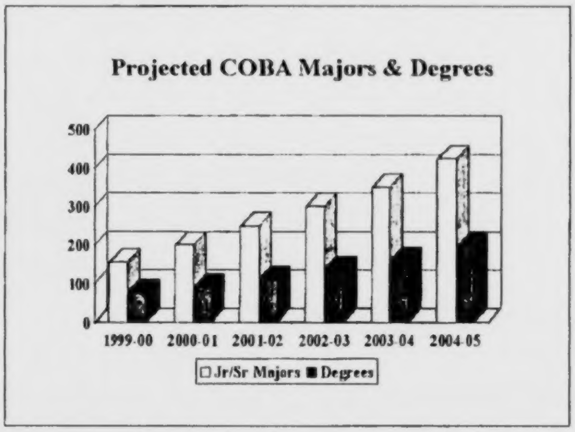
Student and Faculty Projections for the School of Information Technology

A stated goal of the School of IT initiative is to produce 300 graduates per year by 2005. The numbers of degrees granted from the Information Systems (IS) and Computer Science (CS) programs at GSU for the last four years are shown below. Together these programs will generate approximately 100 graduates this academic year. Historically, the mix of graduates from these programs is about 75 percent from IS and 25 percent from CS. Both programs have experienced steady growth, in spite of the “anomaly created by conversion to the semester system just prior to the 1998-1999 academic year. This change inspired many students in both disciplines to complete degree requirements prior to the conversion, thus creating a higher than normal number of graduates in 1997-1998 and a lower than normal number in 1998-1999.

Student Projections

Assuming the historical 75/25 mix continues, it is estimated that the BBA/IS and the proposed BS/IT programs would account for 200+ of the targeted 300 School of IT graduates in 2005, with the remaining graduates coming from other applied degree programs. To produce these 200 graduates annually, the number of junior/senior majors in the BBA/IS and proposed BS/IT degree programs would need to be double that number (or approximately 400). The historical growth rate for junior/senior IS majors is approximately 20 percent per year. If this growth rate continues and is supplemented by aggressive student recruiting programs, the projected the number of junior/senior majors and degrees granted from the proposed COBA programs to be as follows:





Junior and Senior Enrollment in BBA/IS and proposed BS/IT programs

Year →	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005
Majors	155	200	250	300	350	425
Degrees	75	90	110	135	160	195

Faculty Projections

In order to accommodate the projected number of junior/senior BBA/IS and BS/IT students, more than 60 sections of required and elective courses will be required each semester by the 2004/2005 academic year to support anticipated majors. If each faculty member teaches 2 upper level IS/IT courses at 25 students per course with the balance of the teaching load per semester being service courses at 40 students per course, a minimum of 8,900 credit hours will be generated. If each faculty member is responsible for 280 credit hours per semester, as recommended by the AASCB, 32 faculty members will be needed to by the 2004/2005 academic year to deliver the BBA/IS and the BS/IT programs.

The following table provides targets for COBA IS faculty needs for the BBA/IS and proposed BS/IT programs at the end of each academic year. Additional faculty would be required for other programs.

FACILITIES NEEDS

Student and faculty projections clearly indicate that a building will be required to accommodate School of Information Technology degree programs. The following issues were considered in the preliminary planning for this new facility.

Space Considerations/Assumptions

It is anticipated that all BBA/IS and BS/IT courses and labs will be taught in the new building. It is also assumed that the core/service IS courses will continue to be taught in the COBA building and will utilize existing three COBA labs (which are currently capable of handling, 33, 42, and 58 students). It is assumed that this new building will provide adequate classroom, administrative staff/support, and faculty office space to meet the student and faculty projections.

Desired Technology Infrastructure Features

A high bandwidth fiber LAN should be installed in the new building. In anticipation of IT students being required to own laptop computers, connections to the network are recommended for each classroom seat and student work space (including multiple student work/meeting rooms).

Computing Labs and Resources

If School of IT students are required to own laptops, much of the need for traditional computer lab will be eliminated. However, the nature of the proposed IT curriculum will require several specialized labs to provide experience with specialized hardware and software, including the following:

1. A computer lab to provide experience with networking hardware and software.
2. A computer lab to provide experience with web development tools including advanced scanning/digitizing hardware and graphics editing/design software.
3. A computer lab to provide experience with virtual reality/3D modeling and data analysis.
4. A computer lab for hands-on experience with collaborative computing.

Multiple will be required to provide operational support of the school. In addition, multiple servers will be required for dedicated, educational support (e.g., database driven web development, SAP, etc.).

Classroom Features

To attract high-quality IT students, each classroom in the School of Information Technology should be equipped

COBA IS FACULTY NEEDS

Year→	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005
Majors	155	200	250	300	350	425
BBA/IS	155	200	200	225	250	300
BS/IT	0	0	50	75	100	125
Faculty	10	18	22	25	28	32

state-of-the-art educational technologies. These technologies will include network connections for each student's laptop, computer/video projection capabilities, the ability to project any student's screen to the class, VCR/DVD player and audio system, an overhead projector, a built in computer or computer hookup for instructor, and distance learning broadcast capabilities.

eInstitute Proposal

The COBA white paper sub-committee proposed the development of an "eInstitute as an integral component of the School of Information Technology. The proposed institute will provide a mechanism to stimulate economic growth in South Georgia and provide services that extend beyond the academic degree programs. It will work cooperatively with both internal and external constituents, i.e., GSU departments, other university system schools/colleges, area technical schools, businesses, and other independent entities, to meet the challenge of preparing South Georgia to emerge as a leader in the high technology arena.

The eInstitute will offer certificate programs in information systems and information technology to prepare graduates in other disciplines for entry level positions in IT. The certificate programs will be designed to be completed in one year (or less) and offer a "fast track solution to meeting the growing demand for IT workers.

Another key element of the proposed eInstitute is an eBusiness incubator. The incubator will provide facilities and resources for high tech start-up firms to develop and mature. It will involve faculty and students as a pool of available expertise to assist these young companies as they evolve. The incubator will work closely with Georgia Southern's new College of Economic Development in promoting the economic growth of South Georgia.

To partially address the need for additional faculty resources, the eInstitute will develop an ICAPP (Intellectual Capital Assistance Partnership Program) Faculty Development Program. Like the now defunct AACSB MIS Faculty Development Institutes, this ICAPP program will train current terminally qualified faculty in other disciplines to meet the needs of the School of Information Technology as well as the need for IS/IT faculty at other University System of Georgia institutions.

Development and Promotion Planning

The final key element in COBA's School of Information Technology White Paper is a preliminary marketing and recruiting plan. In order to attract high quality majors and faculty, the university must commit the resources to effective marketing the new academic unit. Some of the suggestions included in the preliminary plan include:

General Marking Recommendations

1. Announcing the program via press releases, formal announcement cards, advertisements in professional publications, etc.

2. Sponsoring receptions and/or coffees at professional meetings to announce the program and recruit faculty.

3. Developing brochures and other marketing materials to distribute to high schools, junior colleges, and other sources of prospective students.

4. Offering to speak to professional organizations, civic groups, and alumni groups.

5. Participating in university student recruitment receptions.

Student Recruitment Recommendations

1. Work with the admissions office to secure "Potential Student List(s) of high school students who have both the background and skills for success in a strong IT program.

2. Design brochures, letters, etc. that are specially targeted to high-ability high school and junior college students.

3. A mail/phone recruitment plan utilizing professional staff, faculty, current students, and alumni.

4. Faculty, student, and alumni attendance at recruiting/promotion events.

5. Targeted recruiting efforts designed to attract individuals already in the workforce who want to be retrained in IS/IT.

6. Active recruitment of high ability undeclared majors at GSU.

7. Emphasize the availability of HOPE, University Honors Programs, Bell Honors Program, and IS scholarships.

8. Initiate a summer "IT camp for high ability high school students.

9. Sponsor IT competitions for high school students during the academic year.

10. Create an IT Scholars Program for high school juniors and seniors.

11. Develop a recognition program for Georgia high school students scoring a 4 or a 5 on the AP Computer Science Exam.

12. Directly recruit at IT-oriented magnet schools.

Faculty Recruiting Recommendations

1. Program announcements in all appropriate professional publications/placement materials including IS journals.

2. Send Representatives to Professional Meetings to Recruit

3. Send letters to "interested individuals identified through various personal contacts.

4. Direct contact with Ph.D. programs

5. Recruit ICAPP Advantage students (without threatening AACSB accreditation)

6. Sponsor receptions at professional meetings.

SUMMARY AND CONCLUSIONS

Since being announced on April 29, 1999, much progress has already been made toward creating a School of Information Technology at Georgia Southern University. The school is an aspect of Governor Ray Barnes' high technology economic development initiatives and is designed to address shortages of IT workers in Georgia as well as to serve as a magnet for attracting and expanding IT-producer and heavy IT-user organizations. This new academic unit is tasked with annually producing at least 300 (undergraduate) degrees by the 2004/2005 academic year.

In response to the announcement, the Dean of the College of Business Administration appointed an ad hoc committee charged with producing a white paper outlining a curriculum model for the new academic unit as well as degree program proposals. The degree programs recommended in the white paper blend business knowledge with information technology expertise to address the needs of the targeted industries. Initial input from external sources, including industry management and consultants, appear to validate these proposed curriculum model and degree programs.

The white paper also includes student enrollment projections, projected faculty needs, an outline of facility and resource requirements, a proposal to create an eInstitute, and a preliminary marketing and recruiting plan. The white paper's key recommendations include:

1. The creation of a School of Information Technology that offers applied degrees in information technology. This new school should leverage current strengths and initially be a part of the existing University structure. Future growth may lead to the development of a College of Information Technology.

2. Continued expansion of the BBA/IS degree and the creation of a Bachelor of Science in Information Technology degree program that includes a business minor. This degree will be an applied degree designed to prepare the graduate for a leadership role in the information technology industry.

3. The establishment of an eInstitute to offer services and outreach programs to the region and state. Major components of the eInstitute would be the

eBusiness incubator program and the certificate programs.

4. Aggressive promotion and recruitment of School of IT students and faculty.

Limitations

The actual content of Georgia Southern's white paper may be of limited value to educators and administrators at other universities who are faced with the challenge/opportunity of rapidly growing their IS/IT programs. However, its format and overall framework may serve as an model that other colleges and university's can emulate.

Georgia Southern's white paper is a work in progress. The university committee has just been appointed and COBA's white paper is currently being digested by the members of that committee. It will undoubtedly be modified by the representatives of other key constituencies on the committee, especially those from computer science and the College of Science of Technology. In spite of this, on May 13, 2000 a sign was erected on the vacant lot across the pedestrium from the COBA Building that reads: "Proposed site of the School of Information Technology. An innovative economic development initiative of Governor Roy Barnes.

REFERENCES

Burriss, (1999) "Supply and Demand: Georgia's Technology Workers, *TechLINKS*, November/ December, p. 30.

Chaker, A.M. (2000) "Region Trails in High Tech, Despite Efforts. *Wall Street Journal*, May 17, pp. S1, S3.

Information Technology Association of America, "Bridging the Gap: Information Technology Skills for a New Millennium, http://itaa.org/workforce/ studies/hw00execsumm.htm.

McLean, E., McDonald, D., and Case, T. (1999) *E-Commerce and the State of Georgia: Analyses and Recommendations*, www.icapp.org/pubs/index.html.

McLean, E. and McDonald, D., (2000) "E-commerce and the State of Georgia, *TechLINKS*, March/April, pp. 15, 30).

U. S. Department of Commerce, (1999) *The Emerging Digital Economy*, http://www.commerce. gov/ede/report.html.

U.S. Department of Commerce (1999) *The Digital Work Force: Building Infotech Skills at the Speed of Innovation.*

THE USE OF SOCIAL TRANSLUCENCE IN A DISTANCE EDUCATION SUPPORT ENVIRONMENT

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ABSTRACT

This paper presents a Web-based environment (Web-course) designed for large groups distance learning programs in which students may benefit from the availability of large user and information bases, without losing the advantages of working in small groups. The system implements concepts of Social Translucence developed by Erickson and Kellog [2]. Controlled visibility, mobility and management of student-produced information were built into the course organization and communication tools giving the student more alternatives and control over the process. Although the tools used in Web-course are all available elsewhere, their combination in one single environment could give the learner more flexibility and the instructor higher effectiveness in assisting the student and managing the course.

The results show that collaboration and participation are positively related with visibility, mobility and performance, indicating that the addition of translucence and mobility resources to learning environment can improve the effectiveness of the process. Participant surveys also indicate satisfaction with the tools and results.

INTRODUCTION

Collaborative work can increase the effectiveness of distance learning. In most environments students have access to a common repository of information, to the instructor and support center, and interact more intensely with a small group of other students (their cohort) as part of the learning process. Traditionally growth of the student population is handled by forming more groups, students are assigned permanently to a group at the beginning of the course and information produced in one group usually is not shared with others. As a result, information and skills that may be useful for learning and student motivation are therefore underutilized.

This paper presents a Web-based environment (Web-course) designed for large groups distance learning programs in which students may benefit from the availability of large user and information bases, without losing the advantages of working in small groups. The

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system implements concepts of Social Translucence developed by Erickson and Kellog [2] Controlled visibility, mobility and management of student-produced information were built into the course organization and communication tools that give the student more alternatives and control over the process. Although the tools used in Web-course are all available elsewhere, their combination in one single environment could give the learner more flexibility and the instructor higher effectiveness in assisting the student and managing the course.

CONCEPTUAL BACKGROUND

Groupwork and collaboration, important resources for Distance Education that have been explored by authors like Harasin [3], Murray [4] and others, are also part of the tools implemented in Web-course.

Another important concept for Web-course is "socially translucent systems . The concept "translucent is usually applied to human relations, and represents the amount of information about himself a person shares with others in a social environment. According to Erickson and Kellog [2], social systems can be classified depending on the level of members visibility, ranging from total opacity (no information available on participants) to total transparency (participants are totally visible). Translucence could then be used as a mechanism regulating the interpersonal relationships in a social environment. The present paper explores the concept in relation to group work and collaboration in a Distance Education environment. Translucence was implemented in the form of controlled participant visibility, access to and organization of persistent conversation, aided by mobility among groups and information grouping.

DEFINITIONS

Visibility: The amount of information about himself a person is willing to share with others. Visibility ranges from total opacity (I'm not willing to disclose anything about myself) to total visibility (I want to expose myself completely to others). In a social environment, members are continually controlling their visibility according to contingencies. In a remote environment members are less likely to know each other which may condition their willingness to expose themselves.

Persistent conversation: Messages exchanged among participants are recorded and organized to be accessed later. The recording may impact the participants communication behavior (Erickson and Herring [1].

Mobility: In the Web-course environment mobility represents the freedom participants have in choosing with whom to cooperate (switching groups or initiating new ones). For this choice the participants need to have information about the other participants and existing groups.

Selective Information sharing: Groups can decide on the amount of information they make available to others.

The experiment with Web-course used synchronous (chat) and asynchronous communication tools (forum, bulletin board, e-mail with discussion list and a common area for up- and downloading files). These tools allow various degrees of information structuring, ranging from chat to forum. The amount of structure depends on participants choice of communication protocol and the tools provided for communication.

The environment was developed using the concepts of Visibility and Persistent Communication from Socially Translucent Systems, Computer Mediated Communication tools (chat, e-mail, discussion lists, forum, bulletin board), allowing the presentation of instructional content, instructor support and performance evaluation. The environment allows participation, collaboration , controlled visibility and mobility. Dependent variables are participants satisfaction and learning performance.

THE WEB-COURSE ENVIRONMENT

Web-course is a Web-based learning environment for group or individual learning,, using software built on Windows NT and implemented using Microsoft ASP, Java and SQL Server.

Most communication and presentation tools were custom-developed for Web-course. The only exception was the e-mail based discussion list, which uses a Linux-based version of Majordomo. All user interfaces are based on standard Web browser. The experiment showed also that participants sometimes bypassed the system to use commercially available chat systems, thus avoiding the persistent communication features of Web-course. Participants can control for translucence using individual visibility control, persistent conversation and group mobility.

Each participant can control his/her own visibility to the group. Only name, login code and e-mail address are always visible to all others. This choice of visibility is made in two situations: 1. The participant can supply a text to Web-course with the information about himself he wants to share with all others. 2. Through the choice of tools and content of the messages in the communication process.

An important resource is the bulletin board, which is used for small and focused messages, like scheduling meetings, supplying hints on how-to find information or asking for help. Messages on the bulletin board are sorted by posting date, displaying author, group and text. Messages can be made visible to a single group or all participants.

The forum is also persistent, allowing in addition the structuring of information through a topic hierarchy. Participants may create any number of topics, with up to 11 sub-topics and up to 999 messages in each node. Both bulletin board and forum can be used by participant to search for groups that best suit their specific needs.

The chat is synchronous and all messages are permanently stored and can be retrieved later. Therefore the chat can also be used as an asynchronous communication tool.

Persistent conversations allow participants to know the history of a given process and use messages generated synchronously in an asynchronous mode.

IMPLEMENTING WORKGROUPS AND MOBILITY

Web-course has also resources for groupwork: participants are allowed to create new groups anytime, and can switch groups as often as they wish. A group is identified by its name, creator id and a description of its purpose. In our experiment the group creator had no control over its future content or participants decision to enter or leave the group. The experiment used two types of groups: those created by the participants themselves and those created by the instructor (all participants were originally assigned to one of them). The other was a temporary group (INFO_WEBCOURSE) designed specially for synchronous meetings with the instructor (chat). Participants would enter this group for the meeting only and return immediately to their groups.
In some instances a group became then simply a (temporary) work environment with its tools (forum, chat and bulletin board) storing also the groups history and its context.

In our experiment participants were not allowed to participate simultaneously in more than one group. This limitation (to be removed in future versions of the system) required the participants to switch groups in order to access other groups information.

THE EXPERIMENT AND DATA COLECTION

The basic hypothesis is that an environment with higher (selective) visibility and mobility among groups allows participants to increase collaboration, participation, learning performance and satisfaction.

The experiment was used to test the following relationships among variables:

1. Increased Visibility is related to increased collaboration
2. Increased Visibility is related to increased mobility
3. Increased Mobility is related to increased collaboration
4. Increased Participation is related to increased collaboration
5. Increased Mobility is related to increased Participation
6. Increased Visibility is related to increased Participation
7. Increased Learning Performance is related to increased the variables above

The experiment consisted of a short (20 to 40 hours) skills-building course on "Conducting Effective Meetings ,composed of five modules, the first of which was a group dynamics for team building purposes and exploration of the computing environment. The others consisted of specific tasks, requiring the reading of texts (available for download), guided tours, searching Web sites provided by the instructor and a list of questions to be answered individually by the participants (these answers were graded by the instructor) . Since some of the questions were rather polemic, participants would benefit from discussing them with their peers. Each participant was required to turn in his own answers, but interaction and collaboration was encouraged.

The course can be characterized as semi-asynchronous with support, because of its eventual use of synchronous tools. The instructor offered assistance both by asynchronous answers to questions and previously scheduled synchronous chat sessions.

Course participation was offered to teachers that had been assigned by the Ministry of Education to a Government-sponsored School Informatization Program [5]. These teachers were in charge of regional Educational IT support centers. They knew some of their colleagues from their State, and might have met others at the yearly National Educational Technology Conferences. 143 teachers (out of a total population of 600), from all over the Country volunteered for the course. 75 of them concluding successfully the course and 73 of them answered the questionnaires.

The Internet was used for participants registration and all other course communications.

The total duration of the course was 23 days, with strict deadlines for each of the five modules.

In order to avoid problems with anonymous participation, participants had to register formally and those who concluded successfully the course received certificates issued by the sponsoring University. These certificates could be used in future promotion processes. The data were collected in three stages: First stage: At registration time, the participants supplied demographic information and answered questions related to their expectations for an on-line Internet-based course. Second stage: The system recorded all accesses and participants communications. Third stage: At the end of the experiment, participants answered questions related to their participation and results of the course. In addition, participants who had initiated groups were interviewed for their views of this process.

Table 1 contains the measures made during the experiment and the five dimensions in which these measures were grouped.

The dimension "participation measures the students involvement with activities related to the completion of his own tasks. The dimension "collaboration measures the use of the systems tools for interaction or collaboration with other participants. Mobility measures the frequency of group switches. Visibility measures the amount of personal information shared by the participant and his attitude toward sharing (measured by questionnaire). User satisfaction, attitudes toward collaboration, etc were measured in the questionnaires. These variables were combined forming the aggregate variables: participation, collaboration, mobility, visibility and performance. The other qualitative information was obtained through the pre- and after course questionnaires.

TABLE 1
MEASURES FOR MODEL VARIABLES

Dimension	Measure
Participation	Number of Accesses to Web-course
Participation	Number of Accesses to the Bulletin Board
Participation	Number of Accesses to the Forum
Participation	Number of accesses to chat sessions
Participation	Number of requests for support
Participation	Number of concluded tasks
Collaboration	Number of e-mail sent to discussion lists
Collaboration	Number of files contributed to forum
Collaboration	Number of sent chat messages
Collaboration	Number of questions or answers sent to bulletin board
Mobility	Number of group switches
Visibility	Personal information supplied to Web-course
Performance	Average participants grades

RESULTS

The objective of the experiment was to identify the level of satisfaction of participants with the environment, the relationship among the dimensions: participation, collaboration, mobility and visibility and the influence of these factors on participants learning performance.

Overall participants satisfaction with the course: on a scale from 0 (worst) to 10 (best), participants rated the course (Table 2).

TABLE 2
PARTICIPANT COURSE RATINGS

Rating	Frequency (%)	Cumulative Frequency (%)
0 to 6	0	0
7	6.8	6.8
8	27.4	34.2
9	31.5	65.8
10	34.2	100

This indicates a high satisfaction with the experiment. It should be noted that the participants considered the course subject important to their jobs and valued highly the course content and structure and specially the instructor support.

PARTICIPANTS DATA

70.3% have a computer and Internet access at home.
Only 21% had previous experience with distance education
Only 8% had less than 2 years of experience with computers
14% had less than 1 year of experience with the Internet
80% accessed the Internet every day
66% were connected to the Intemet between 20 and 60 hours per month
70% worked between 20 and 40 hours to complete the course
80% would access the Web-course site more than 5 days a week
55% declared having used other tools, besides Web-course (ICQ, MIRC) for their coursework
47.6% of the participants abandoned the course for various reasons.
13 Participants created a total of 14 new groups, of which only two attracted a significant number of members. 8 of these group creators concluded the course.

COMMUNICATION PATTERNS

TABLE 3
PARTICIPANTS NOT SENDING A SINGLE MESSAGE USING EACH TOOL
(% OF TOTAL NUMBER OF PARTICIPANTS)

Tool	Participants concluding course	Participants abandoning course
Chat	38.7	72.1
Bulletin Board	54.7	80.9
Forum	60	82.4
Support service (e-mail)	65	100
Discussion list	77.3	100

TABLE 4
NUMBER OF MESSAGES SENT USING EACH TOOL

Tool	Average per participant	Standard deviation
Chat	26.7	64.4
Bulletin Board	2.1	3.8
Forum	1.4	2.2
Support	0.7	1.4
Discussion List	0.6	1.7

Visibility: 58.7% of concluding participants did not disclose additional personal information (77.9% for non-concluding). 80% of concluding participants did not read other participants personal information and favor for collaboration those who had disclosed personal information.

PARTICIPANTS MOBILITY

Table 5 shows participants mobility among groups. At the beginning of the course all participants were assigned to group G01. G02 was a special group, created and used by the instructor for his scheduled chats with participants. Participants had to switch to G02 in order to participate in each chat session.

TABLE 5
MOBILITY AMONG GROUPS. (ROW = FROM, COLUMN = TO)

From/ To	G0 1	G0 2	G0 3	G0 4	G0 5	G0 6	G0 7	G0 8	G0 9	G1 0	G1 1	G1 2	G1 3	G1 4	TOT
G01		50	1	28	10	3	3	2	3			4	2		106
G02	22		4	29	6	4	2	2	4	2		3	5		83
G03	1	5		1											7
G04	13	31		2		2	1	1	1	1	1				53
G05	7	6						1				1			15
G06	2	2			2		1	1					1		9
G07	2	1		4					1						8
G08	2	2			2								1		7
G09	3	5	1	2											11
G10	2	2				1								1	6
G11									1						1
G12	2	2		2	2										8
G13		6					1			1		1			9
G14		1								1					2
TOT	56	113	6	68	22	10	8	7	10	5	1	9	9	1	

DEFINITION OF VARIABLES AND TESTING THE HYPOTHESES

The concepts were measured by indices, constructed from the basic measures. These indices (one for each concept), were built as weighted sums of the variables for each dimension (Table 1). The weights were defined by the authors as a measure of their relative importance. The average for each index was defined as the weighted sum of the original variables. This average was used to create a dicotomic value (high or low) for each observation, to be used to test the hypotheses. Each combination would then result in a 2 X 2 matrix, to be tested using Qui-square (with correction for continuity for N>40), with the use of the SPSS v 8.0 package.

For each participant there would be calculated a value (V) for the following indices.

Ipart: degree of participation
Icollab: degree of collaboration
Imobi: degree of mobility
Ivisi: degree of visibility

For each index there was also obtained the weighted average (C), the cutting point, used to define the high/low values for each observation. In detail, the index and cutting point for Participation were calculated as:

$$C_{part} = 14{,}43*0{,}10 + 14{,}17*0{,}20 + 3{,}76*0{,}20 + 4{,}34*0{,}20 + 0{,}36*0{,}20 + 2{,}85*0{,}10$$

$$V_{part} = LPLOGON*0{,}10 + LPBULLET*0{,}20 + LPFORUM*0{,}20 + LPCHAT*0{,}20 + LPSUPPORT*0{,}20 + LPACTIVIT*0{,}10$$

$$\begin{aligned} I_{part} &= \text{low, if } V_{part} < C_{part} \\ I_{part} &= \text{high, if } V_{partb} >= C_{part} \end{aligned} \qquad (1)$$

Where LPLOGON is the Number of Accesses to Web-course, LPBULLET is the Number of Accesses to the Bulletin Board, LPFORUM is the Number of Accesses to the Forum, LPCHAT is the Number of accesses to chat sessions, LPSUPPORT is the Number of requests for support and LPACTIVIT is the Number of concluded tasks. The values used to define C are the averages of the variables observed in the sample.

I_{collab} was defined in a similar way, with the variables presented in Table 1.

$$C_{collab} = 0{,}30 * 0{,}10 + 16{,}63 * 0{,}30 + 0{,}99 * 0{,}30 + 1{,}63 * 0{,}30$$

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$$V_{collab} = LCEMAIL * 0{,}10 + LCCHAT * 0{,}30 + LCFORUM * 0{,}30 + LCBULLET * 0{,}30$$

$$I_{collab} = \text{low, if } V_{collab} < B_{collab}$$

$$I_{collab} = \text{high, if } V_{collab} >= B_{collab} \quad (2)$$

Were LCEMAIL is the Number of e-mail sent to discussion lists, LCCHAT is the Number of sent chat messages, LCFORUM is the Number of files contributed to forum, LCBULLET is the Number of questions or answers sent to bulletin board. The values used to define C are the averages of the variables observed in the sample.

According to Table 1, Mobility is defined by one single variable: the number of group switches (LMGROUP), with an average value of 2. Therefore,

$$I_{mobi} = \text{low, if LMGROUP} < 2$$

$$I_{mobi} = \text{high, if LMGROUP} >= 2 \quad (3)$$

The visibility index (I_{visi}) was defined as follows: "high for each participant providing a text about him/herself and "low otherwise.

The following relationships were found to be statistically significant (at the 1% significance level) in the sample.

Visibility and collaboration
Mobility and collaboration
Participation and collaboration
Mobility and participation
Visibility and participation

The relationship between mobility and visibility was not found to be statistically significant (at the 1% level). These results allow the inference that participants that expose themselves little, participate little, tend to be less collaborative and more static (low mobility among groups). Performance is also significantly correlated with participation and collaboration.

QUALITATIVE RESULTS

From the questionnaires and user interviews the authors could also conclude the following.

1. The participants valued highly the support provided by the instructor and his team, particularly the fast return. During the 23 days of the course, the team provided about 100 hours of support, mainly by e-mail. This helped motivating the participant to remain active.

2. Technology is still a problem: Participants indicated they had problems with their Internet connection, low bandwidth, system and application configuration, etc. which could be particularly annoying during synchronous chat sessions with peers or the instructor.

3. Participants demonstrated that they prefer to work synchronously (using chat). Preferred times were after lunch (1 to 2pm) or early evening (8pm). Chat session with the instructor (held every 2 or 3 days) attracted between 2 and 15 participants and were highly valued.

4. The participants preference for synchronous chat and little use of mobility may indicate that they value more traditional (hierarchical) teaching/learning methods.

5. Some participants had difficulty in structuring their communication and selecting the most appropriate tool (using instead the tools they knew best, like the bulletin board for chat-like communication, etc)

6. Structuring the group activities was also a problem for most groups(defining protocols for the use of each tool, defining forum topics, scheduling chats, etc) This indicates that there is a learning curve for this type of tools, even for experienced computer users. In fact, participants use the tools they are more familiar with, instead of the most appropriate ones: e-mail was preferred over forum, even for longer "threaded' discussions, at the loss of structure and clarity.

7. Participants tended to cluster in rather stable groups characterized by regional origin, in detriment of subject oriented groups.

Tables 6 and 7 were obtained from the user questionnaires. The (high) motivation of participants during the course may be related to their perception of course quality and perceived performance. Based on self-evaluation, 74% of the participants concluding the course rated their own performance with grades above 8 (on a 0 to 10 scale) and only 26% rated it between 6 and 7. The course content also received high marks, with 82% considering it excellent (grades 9 and 10) and 18% rating it good (grades 7 and 8).

TABLE 6
SELF-EVALUATION OF PARTICIPANTS CONCLUDING THE COURSE

Grade	Frequency	%	% accum.
6	7	9,6	9,6
7	12	16,4	26,0
8	42	57,5	83,6
9	8	11,0	94,5
10	4	5,5	100,0
Total	73	100,0	

The results indicated also that participants have to learn to work in this richer environment (creating and switching groups, searching for course-wide group generated information, publishing group information, etc.). Successful participant-created groups were usually based on existing social ties (regional groups) or had a very narrow task focus. Many groups did not succeed in attracting participation. Searching participant-produced information and switching groups was heavily used only by a small group of participants.

TABLE 7
EVALUATION OF COURSE CONTENT BY PARTICIPANTS CONCLUDING THE COURSE

Grade	Frequency	%	% accum
7	3	4,1	4,1
8	10	13,7	17,8
9	21	28,8	46,6
10	39	53,4	100,0
Total	73	100,0	

CONCLUSIONS

The results show that collaboration and participation are positively related with visibility, mobility and performance, indicating that the addition of translucence and mobility resources to learning environment can improve the effectiveness of the process. The results indicate that users are satisfied with the Web-course environment, allowing them more flexibility in workgroup collaboration and access to user-generated information. The multiple tools give the instructor a better view of students performance and allows more effective intervention in the learning process. The usefulness of the different tools will depend on the characteristics of the course activities, on the students skills in using them and on students learning behavior, since they must learn to take advantage of the new possibilities of collaborative work, breaking away from imposed static structures. Course designers will also have new possibilities for designing students activities. Students prefer workgroups that have social cohesion or a strong task focus. Future developments of Web-course will allow more participants control over the group forming and switching process and better tools for (selective) sharing of information produced by the groups and also access to statistical data on group behavior.

REFERENCES

[1] Erickson, T and Herring, S., "Persistent Conversations: Dialog Between Design and Research. *Proceedings of the 33rd. Hawaii International Conference on System Sciences*, January 2000.

[2] Erickson, T. and Kellog, T., "Social Translucence: An Approach to Designing Systems that Support Social Processes. On-line: http://www.pliant.org/personal/Tom_Erickson/st_TOCHI.html, page accessed in August 1999.

[3] Harasin, L., "A Framework for Online Learning: The Virtual-U. *IEEE Computer*, September 1999.

[4] Murray, W. G, Salari, S and Swoboda, P., "Worldwide Web Course T: An Environment for Building WWW-Based Courses. On-line: http://www.webct.com/library/#a0, page accessed in July 1999.

[5] "PROINFO , National Program for School Informatization, Brazilian Ministry of Education, On-line: http://www.proinfo.gov.br, page accessed in October 1999.

TRAINING STUDENTS IN DISTRIBUTED COLLABORATION: EXPERIENCES FROM TWO PILOT PROJECTS

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ABSTRACT

Distributed collaboration supported by different forms of information and communication technologies (ICT) is becoming increasingly widespread. Effective realization of technology supported, distributed collaboration requires learning and careful attention to both technological and organizational aspects of the collaboration. Despite increasing focus on the use of ICT in education, for example in the form of distance learning and computer supported collaborative learning, there still are few educational programs that include an explicit focus on providing the students with practical training in distributed collaboration. This article presents the results and experiences from two student projects conducted at Agder University College in Norway, where groups of students from campuses in two different cities engaged in distributed collaboration supported by different forms of collaboration technology. The project illustrates how students perceived this form of distributed work to be interesting and stimulating, but also challenging and time consuming. Task definitions and balancing of motivational factors were found to have a great impact on the groups' efforts, sharing of workload and final outcome. Further, the projects also illustrate how "technical noise" and lack of experience with the technologies represented barriers to effective collaboration, implying a need for training the students in integrated use of different communication services. Based on the experiences from the two pilot projects, the paper presents practical implications for developing and conducting similar projects.

INTRODUCTION

Different forms of IT supported collaboration across geographical distance become increasingly widespread in today's organizations. This can be seen as a result of several factors. The development towards global and dynamic markets creates a need for flexibility in time and place for organizational work tasks. Further, the technological development has now reached a stage where different communication tools can be acquired "off the shelf, and where bandwidth and quality of communication no longer represent unobtrusive barriers to distributed interaction. Through combined use of different collaboration technologies like e-mail, desktop videoconferencing systems, application sharing and document exchange, distributed collaboration today can be equally effective as co-located work. Distributed collaboration here comprises different forms as related to organizational scope and time frame, and may include both intraorganizational collaboration between geographically dispersed units in large organizations, and project based networks among small and medium sized enterprises (Line, 1999a; Munkvold, 1999).

In academic research, virtual teamwork has long been presented as a key element in the "organizations of the future" (e.g., Cohen, 1993; Davidow & Malone, 1992; Keen 1991; Vitalari, 1990). However, it is only during the last five years or so that this has become reality, as a result of the technological development described above. These solutions thus have developed from "hype" into being characterized as "mission critical" by many organizations today. It is important here to realize that effective deployment of distributed collaboration does not come about by itself, but requires active learning and understanding of both technological and social aspects by the actors involved. It is therefore necessary for educational institutions to develop study programmes that provide the students with adequate background and training in this new form of work. While there is much activity today centred around the use of ICT in distance learning as a substitute for traditional classroom teaching, there are still few study programmes that offer explicit and practical training in effective, distributed collaboration.

This paper presents the experiences from two pilot projects in distributed collaboration among students, conducted at Agder University College (AUC) in Norway during fall 1998 and fall 1999. In these projects, groups comprising students from two different courses given at AUC's campuses in the cities of Kristiansand and Grimstad worked together on a project assignment over a period of two-three weeks. During this period, the groups collaborated entirely over the net, supported by a selection of different technologies for distributed collaboration: e-mail, application sharing, audio and videoconferencing, document repositories and discussion databases. Through presentation and discussion of the experiences from these projects, the goal is here to establish a foundation for further development of this type of educational offerings, and to stimulate discussion on the conduct of similar projects.

The article is structured as follows. The next section provides a brief overview of related research on distributed collaboration and use of ICT in education. This is followed by a description of the two pilot projects, and a subsequent discussion of the experiences from the conduct of these projects. The last section presents implications for developing similar projects for training students in distributed collaboration, as well as implications for further research and practice.

OVERVIEW OF RELATED RESEARCH

Distributed collaboration supported by IT is at focus in several research arenas. This section presents a brief overview of some of these research activities.

Computer-Mediated Communication

In the area of *Computer-Mediated Communication (CMC)*, studies of how "electronic communication" affects interpersonal interaction and collaboration in distributed settings have been conducted for more than two decades (e.g., Hiltz & Turoff, 1978; Short et al., 1976). Most of this research is of an experimental nature, being conducted in controlled environments (e.g., classroom settings) with students as subjects, working on artificial tasks. A large part of the research on distributed collaboration has focused on some form of teamwork, and different variables related to group dynamics and group characteristics have therefore constituted key elements in the research models developed. A range of different factors have been studied in these experiments, such as the effects of technology support on effectiveness and quality in decision processes, and participants' perception of process and outcome. A meta-analysis of the results from a selection of these studies indicates that users normally are capable of adapting to the changes in communication form implied by use of technology support, and that use of electronic communication does not result in reduced quality of outcome. In some cases it may even lead to better quality through stronger task focus and the possibility for more in-depth analysis (Munkvold, 1996). On the other hand, there are also several examples of how the time used for making decisions in this form of collaboration increases, and of team members reporting reduced satisfaction with the group process.

The experimental context in which these results are generated clearly limits the transferability to distributed teamwork in real organizations. Typical for these studies is also a focus on comparison between distributed and co-located ("face-to-face") teamwork. In several organizations, distributed collaboration will represent the only possible alternative due to geographical barriers (Line, 1999a). Further, it is worth noting that the technology used in these studies often is limited to e-mail and text based conferencing systems, and does not include richer communication media like desktop videoconferencing and application sharing.

Virtual Teamwork

During the last five years there has been a growing interest in so-called virtual teamwork (e.g., Lipnack & Stamps, 1997), where team members collaborate from several geographical locations supported by different types of communication technologies. Much of the research related to this form of collaboration still suffers from the same limitations as earlier CMC-studies, i.e. lack of realistic context and limitations in technology support. Several projects that are being presented as "advanced" examples of virtual collaboration are actually based on e-mail as the only form of technology support (e.g., Knoll & Jarvenpaa, 1998).

Concurrent Engineering

While virtual collaboration in administrative office work until recently has had a rather "exotic" character, there is a long tradition in the engineering disciplines for this form of work. For example, in Norway the construction and oil industries have been early adopters of ICT for supporting coordination and information exchange between different actors. In general, the area termed *Concurrent Engineering (CE)* comprises several examples from different industries of relatively advanced, distributed collaboration projects regarding technology support and complexity (e.g., Ashby et al., 1995).

ICT in Education

In education today there is an increasing focus on the use of ICT both to enable new teaching methods and to increase efficiency for traditional instructional methods. This relates both to distance learning (e.g., Dede, 1996) and computer supported collaborative learning (CSCL) (e.g., Brandon & Hollingshead, 1999; McConnell, 1994; Seufert & Seufert, 1998). Fjuk (1998) introduces the term *Computer Support for distributed Collaborative Learning (CSdCL)* for denoting the intersection between these two areas, thus also including physical distance among the collaborating students. There is also an increasing use of Internet and the World Wide Web for supporting various forms of learning approaches (Bandi & Nakatani, 1998; Dufner et. al., 1999; O'Leary & Fischer, 1998). In general, the activity related to the use of ICT in educational settings is largely focused on supporting the learning process (e.g., Beranek & Loch, 1999; Vreede et al., 1999). There are still few courses that focus on how the technology can be used effectively to support distributed collaboration.

Conclusion

A conclusion from this brief overview of related research is thus that there exist few course offerings that focus explicitly on distributed collaboration *in practice*. Further, we argue that the research related to distributed collaboration supported by ICT is still at an early stage, at least if realism in context and use of state of the art technologies are applied as criteria for maturity. However, we need to stress that the projects reported in this study have had the character of practical pilot projects in an educational context, and therefore have not followed a stringent research design regarding data collection and analysis. The primary purpose of the projects has thus been to generate experiences that can form a basis for further development of instructional methods for training students in practical, distributed collaboration.

STUDENTS IN THE WILD — DESCRIPTION OF THE TWO PILOT PROJECTS

This section provides a description of the scope and conduct of the two student projects in distributed collaboration conducted at AUC during the fall terms of 1998 and 1999. Discussion of experiences and results from the projects are presented in the next section.

Background and Purpose

The idea for these projects was conceived during a discussion on how to develop common teaching modules for the following two courses:

> *Coordination Technology* - second year course in the two year Master of Engineering programme in Information and Communication Technology (ICT) at the AUC campus in Grimstad
>
> *Computer-Supported Cooperative Work (CSCW)* - first year course in the two year Masters

programme in Information Systems (IS) at the AUC campus in Kristiansand

By establishing distributed project groups across the two courses, the purpose was to give the students practical experience with distributed teamwork, including coordination and use of different forms of collaboration technology. The contents of the project assignment should be a relevant course topic and mimic a real world task as closely as possible. A third goal was to establish an arena for interaction between the students from these two programmes. This contact is normally restricted by the geographical distance (60 km) between the two study locations. So far, this project has been conducted for two successive years, with adjustments being made based on the experiences from the first year. In the following we provide a brief description of the two projects, including an overall evaluation of the results.

Pilot Project 1

The first project was planned during summer 1998 and started approximately one month after start-up of the semester. The assignment given was to compare the functionality of two "groupware platforms": Microsoft Exchange/Outlook and Lotus Notes/Domino. These two technology platforms were used this year as the basic infrastructure in the two courses, in Grimstad and Kristiansand respectively. Table 1 presents the key contents of the project.

Data Collection

Different forms of data collection were conducted during the project period, as a basis for the evaluation of the pilot project. The experience reports were specified at the outset as to include the following topics: the group's organization of the project, use of technology support, experiences from the collaboration in the group, and reflections on how the group would conduct a similar project in the future. By having the participants from each course hand in separate experience reports, we wanted to give them the opportunity for presenting their experiences and views related to sharing of workload and collaboration in general with the participants from the other course. The students were guaranteed that these reports would be confidential, read by the two instructors only.

In addition to the experience reports from the groups, a web based form for self-reporting of activities during the project period was created. The groups could also print out the form and fill this in manually. The groups were requested to hand in this activity log as an attachment to the experience report. Only three of the five groups used the form. This can be ascribed to several factors. First, the form was not available until a week after the project had started. Second, the instructions to the students were not sufficiently explicit on the need for appointing a group member as responsible for the logging of activities. Consequently, for some groups this was given low priority compared to the work on the assignment itself.

Overall Evaluation of the Project

Evaluation of the groups' results in the form of project reports and presentations shows that the groups to a varying extent managed to solve the task assigned (the project reports are available at http://siving.hia.no/ikt97/it4200/). All the groups had chosen to divide the project between their distributed units, so that the participants from each course were responsible for the groupware product available at their site. This could be expected, but both the reports and the related presentations revealed that several of the groups had not succeeded in coordinating the contents and presentation regarding comparison of the two products. For several of the groups their result was limited to including a separate description of the functionality for each product.

The project was reported by the students to be time-consuming and almost of an "absorbing" nature, at the expense of other course work. This must also be related to the fairly broad task assigned, requiring delimitation of focus by the students. According to several of the groups, the difference in evaluation form between the two courses also resulted in that motivation and effort put into the project was unequal among the participants from each course.

Lecturing continued as normal during the project period and the students were responsible for coordination and finding time for the project work. Some groups experienced difficulties with finding available time for synchronous sessions/meetings, due to the different schedules for the two study programmes.

Supervision was conducted in the form of the instructor at each site answering questions from students in his course. Thus, there was no supervision with the entire group present. A problem with this form of "local" supervision was that different interpretations among the two instructors also occurred sometimes, thus leading to confusion and frustration among the students.

TABLE 1
KEY CONTENTS OF PILOT PROJECT 1

Pilot project 1
Assignment Comparison of Microsoft Exchange/Outlook and Lotus Notes/Domino on the following areas of functionality: E-mail, Internet integration, Application Development Environment, Database structure, Security
Deliveries Written report, half hour presentation in class. Two experience reports per group, from the participants from each course.
Evaluation/Incentives Part of the mandatory assignments for both courses. For ICT students the projects were graded, comprising 10 % of the total grade. For IS students the projects were graded as 'passed/fail'.
Schedule Prior to the project, students in both courses were given an introductory lecture on application sharing and some practical exercise with Microsoft NetMeeting. The project activities were scheduled as follows: Kick-off seminar at AUC Kristiansand. Introductory lecture on distributed collaboration. Forming groups, selection of topics. Lunch in groups, introduction/getting acquainted. 2 hours with group work on problem specification and planning. Concluding guest lecture from Lotus Notes vendor. Distributed project work for three weeks. No face-to-face contact between participants from the two courses. Group members from same course allowed to work face-to-face. Face-to-face supervision available from the course instructors in Grimstad and Kristiansand on request. Closing seminar at AUC Grimstad. Groups working for 2 hours finalizing their reports. Group presentations in class. Guest lecture from vendor focusing on comparison between MS Exchange/Outlook and Lotus Notes.
Group composition 6-7 person groups with 3-4 students from each course. 5 groups in all, with a total of 18 IS-students and 16 ICT students.
Infrastructure The students in both courses had a dedicated PC lab at their disposal, offering access to the following technologies/applications: E-mail (MS Exchange Outlook in Grimstad and Eudora Pro 3.0 in Kristiansand) Microsoft NetMeeting v. 2.01 Lotus Notes v. 4.5 (Domino) World Wide Web (WWW) Since MS Exchange/Outlook and Lotus Notes only were installed at one campus each, remote access to the tools was provided through use of MS NetMeeting and by accessing the products over the Internet through a web browser. To enable the last approach, guest accounts for remote login were created at each site.

Pilot Project 2

The project was repeated during the next conduct of the two courses the following year. Table 2 outlines the key contents of the second pilot project. Several changes were made based on the experiences from the first pilot project. In addition, the group composition was also different, due to uneven numbers of students in the two courses this year. The changes made are summarized in the following:

Task made simpler and more cohesive
The assignment in pilot project 2 was chosen on the basis that it was simpler, requiring less work for clarification and delimitation of focus and thus making it easier for the students to start on the actual work. Further, the task should be "cohesive" for the group, and not of a nature that invited for dividing subtasks between participants from the two courses.

Incentives made more equal
Incentives were made more equal for the two student groups, by grading the project in the IS course as well. However, due to practical concerns, the assignments still comprised different percentages of the total grade.

Shorter project duration
The duration of the project was reduced to two weeks, to avoid taking up too much time during the semester.

More time for group work during the kick-off seminar
The time for group work during the seminar was extended somewhat, to give more time for planning the project and building relationships.

Coordination of course schedules
The schedules for the two courses were coordinated to make it easy for the students to find time for synchronous collaboration.

Group-wise supervision
Each group was assigned one instructor as supervisor, to ensure consistent advice and avoid redundant information.

Group composition
Due to changes in the Master programme in Kristiansand, the number of IS students participating in the project this year was considerably less than for the ICT students, leading to uneven numbers in the groups. This made it necessary to form two groups comprising ICT students only. Most of the students in these groups worked from the same location (three of them were part time students and therefore worked in a "real" distributed setting), but were asked to "simulate" distributed collaboration by using electronic communication only.

Appointment of "observers"
One ICT student in each group was assigned the role as "observer" with responsibility for logging technology use and process data for the experience reports.

Regarding infrastructure, the same technologies were available as for project 1 (with some upgrades) with the addition of two PCs with Intel Proshare, supporting desktop videoconferencing. Further, mobile telephones were found to be frequently used by the students, although not being part of the "designed" project infrastructure.

Data Collection

Similar to the first pilot project, the experience reports including the log of communication sessions were the main source of data. In addition, pre and post surveys were conducted for the second project. The pre survey was conducted at the end of the kick-off seminar, asking the students about their previous experience with distributed collaboration, and their expectations for the distributed project regarding efficiency, quality of outcome and personal satisfaction as compared to traditional, co-located teamwork. The post survey was conducted after completion of the project by using the GroupSystems survey tool. The IS students completed the survey in class, giving 8 out of 8 possible responses. Due to limited installation of GroupSystems in Grimstad, the GroupSystems form had to be distributed by e-mail to the ICT students. 15 out of 31 possible responses were returned, giving a total response rate for the survey of 59 %. The post survey covered the students' experiences from the project regarding perceived quality and efficiency, and their satisfaction with the process and learning outcome. The analysis showed no significant differences in the answers between the two student groups. The results from the two surveys will here only be used for supporting the analysis of the experience reports in the next section.

TABLE 2
KEY CONTENTS OF PILOT PROJECT 2

Pilot project 2
Assignment Developing a web-site presenting information on one of the following technologies: Palm PCs, PC-based real-time conferencing, Electronic meeting support systems, Workflow, Document administration, Streaming multimedia. The web-site should cover the following parts: introduction and overview of the area, presentation of a framework for comparison of related products, product overviews and links to related research and communities.
Deliveries Web-site, 20 minute presentation in class. Two experience reports from each group, from participants from each course.
Evaluation/Incentives Part of the mandatory assignments for both courses. The project was graded in both courses, comprising 10 % of the total grade for ICT students and 20 % for the IS students.
Schedule Prior to the project, students in both courses were given an introductory lecture on application sharing. In addition, the IS students were given some practical exercise with Microsoft NetMeeting. The project activities were scheduled as follows: Kick-off seminar at AUC Kristiansand. Introductory lecture on distributed collaboration. Forming groups, selection of topics. Lunch in groups, introduction/getting acquainted. 2 1/2 hours with group work on problem specification and planning. Concluding lecture on distributed teamwork. Distributed project work for two weeks. No face-to-face contact between participants from the two courses. Group members from same course allowed to work face-to-face. Each group assigned one instructor as supervisor. Closing seminar at AUC Grimstad. Video transferred guest lecture on digital communication and organizational challenges. Groups finalizing their presentations. Lunch. Group presentations in class.
Group composition 3 groups with 2 IS students and 4 ICT students, 1 group with 2 IS students and 3 ICT students, 2 groups with 2x4 ICT students in each. One ICT student as observer in each group. A total of 8 IS students and 31 ICT students.
Infrastructure The students in both courses had a dedicated PC lab at their disposal, offering access to the following technologies/applications: E-mail (MS Exchange Outlook in Grimstad and Eudora Pro 3.0 in Kristiansand) Microsoft NetMeeting v. 2.11/3.01 2 Intel Proshare workstations placed in dedicated rooms close to the PC labs at each site Lotus Notes v. 4.5 (Domino) World Wide Web (WWW) Mobile phones (used by the students as a supplement to the specified infrastructure)

Overall Evaluation of the Project

All groups presented a common web-site for their work and in general all main questions were answered (web-sites (in Norwegian) are available at http://ikt98.grm.hia.no/ikt4200/). Most of the presentations were of good quality and reflected that considerable work had been put into the projects. However, the quality of the web-sites varied significantly in contents and structure. The presentations showed that most of the groups had divided the tasks between the students in the two courses, so that the ICT students were responsible for the technical part related to the design and development of the web-pages, with the IS students as content providers. Still, the end product was more integrated and coherent than for the first pilot project.

Despite the course schedules being coordinated at the outset, some groups still reported difficulties in finding available time for synchronous meetings. As the number of part time students was greater this year, especially among the IS students, this meant that several of the students were only able to work on the project after normal hours.

One of the two groups comprising ICT students only reported that they had followed the instructions and simulated distributed collaboration, using electronic communication only. The other group felt it to be inconvenient and unnatural to use these communication services, as they in fact were working in the same PC lab. They had therefore chosen to complete the assignment in their "normal" way of working, using face-to-face meetings.

In general, the groups had very few questions for the supervisors this time. This can be explained by the relatively simple nature of the task, at least as compared to the assignment in pilot project 1.

DISCUSSION OF EXPERIENCES FROM THE PROJECTS

Use of Technology

The experience reports draw a fairly unambiguous picture of how the groups used the communication services and their evaluation of the different services. An overview of the services and their characteristic use is given in Table 3. The "noise" column indicates the level of experienced technical problems disturbing the communication. These include both "real" technical problems and problems caused by insufficient user competence. Use patterns for the individual services are elaborated in the rest of this section.

E-mail

The participating students can be characterized as experienced e-mail users. All groups reported frequent use and point to e-mail as the basic and most important service. Although mainly used for coordination and short messages, some of the logged messages also contain examples of "rich communication" (Lee,

TABLE 3
OVERVIEW OF TECHNOLOGY USE

Service	"Noise"	General use	Pilot project 1	Pilot project 2
E-mail	No	Service most used; messages, coordination, exchange of documents and information, short discussions		
NetMeeting	Considerable	Important service for most groups; application sharing, audio and some chat	Mostly used for one to one meetings; explaining concepts and demonstrating product	Mostly used as support for meetings with several participants
Video-conference	Considerable	Group meetings, not important	N/A	Experimental
Document repositories	Some	Repositories for common documents. Of moderate to high importance to some groups, not used by others.		
Web	Little	Information search, publishing of results, web interface to other services	Important, but not the only source of information	The only source of information
Mobile phones	No	Messages, coordination, "get in contact, backup audio channel	No use reported	Use reported by all groups

1994). For example, we noticed a "heated discussion" that probably should not have been conducted through e-mail (the supervisor was cc'ed to be informed about lack of commitment from two members of a group). Another group reported a "dangerous situation" where the air was cleared by a phone call. Several groups pointed to or discussed limitations in the use of e-mail, e.g., difficulty in conducting longer discussions, a contextual information and information overload. However, it is difficult here to separate real experience from "show off" of the course curriculum.

NetMeeting (NM)

The students had relatively little experience in use of NM. Hence most of the groups used some time "troubling" and experimenting with the technology. NM supports multipart application sharing, whiteboard and chat. Unless you are connected to a Multipart Conferencing Unit (MCU), the audio and video connections only support two participants. This information was given to the students in lectures prior to both pilot projects. Still, most of the groups in the second project reported that they were not aware of this limitation and that they had spent much time trying to get a multipart audio conference working. In general, the audio quality is reported as a source of "technical noise. Several case studies report that normal practice in industry is to support multipart NM conferences with load speaking phones (Line, 1998; Mark et al. 1999). The students did not have access to this type of equipment and did not have their own cubicles or office spaces. This difference limits the potential use of the service.

Except for two groups (one in each pilot project), all groups perceived NM to be of practical use, and saw the potential for this type of service. The reported frequency of use was in average two-three times per week, with duration varying from 15 minutes to 3 hours.

In the first project, the most common use of NM was a meeting with two participants who both used headset with microphone. The typical use was mutual demonstrations of features in the two products that should be compared, discussion of the project report and discussion of the presentation material (PowerPoint documents). These sessions were reported to be focused and efficient. In some cases this practice was reported to be a source of "free riding, as expressed by the following statement from one of the groups:

> *the group members that do not participate in the discussions are not involved in the tasks in the same way. This may lead to less commitment and involvement.*

In the second project, NM was often used as a support for scheduled meetings that involved all group members. Overlooking the earlier mentioned "technical noise, the groups were mainly satisfied with these meetings. However, several noted that they regarded it as a formal tool, i.e. the communication channel did not sustain "small talk."

Videoconferencing

Videoconferencing was only available in the second conduct of the project. Some students had experience with use of the equipment, but unfortunately there was not time for systematic training of all groups. All groups used the equipment at least once. Some groups experienced "technical noise, probably caused by lack of experience and competence, "itchy fingers" and curiosity about the different features. The general impression is that they found it interesting and more informal then NM. The added value to the meetings was found to be relatively marginal.

Document Repositories/Discussion Databases

In both projects, several groups established some form of discussion database or document repository. These services were created by Lotus Notes/Domino/Teamroom, Microsoft FrontPage and a Web based Extranet product. None of the groups reported any use of these services for real discussions. The normal use of these services was as a common document repository. To some of the groups, the work with establishing this service was also relevant for the assigned task (Internet integration and database structure in the first project, and document management in the second project).

World Wide Web (WWW)

The important use of WWW was information retrieval and publishing of the deliveries. Although not explicitly reported, the information search capabilities were more important in the second project due to the nature of the assignment. Some groups mentioned problems with finding relevant, unbiased and qualified information. The referenced material is to a large extent clearly biased (vendor data sheets, white papers, etc.). Though not investigated in detail, it is our impression that most of the groups were aware of this and treated this type of information with necessary caution.

Almost all groups in the second pilot project appointed a "webmaster" responsible for the final publishing of the deliveries, or delegated this task to the ICT students in the group. Given the ICT students' former experience with and access to the web publishing tool, this can be seen as a natural decision and is not reported to have caused major problems for the work. Some groups used web interfaced document repositories. In the first pilot project, the web interface in Exchange/Outlook and Notes/Domino was used for remote access in comparison of the two products. Due to the limited features available in the web interface, most groups reported that NetMeeting was a more suited service to support this task.

Mobile Phones

The use of mobile phones is an interesting difference between the first and second conduct of the pilot project. In the second project, almost all groups reported use of mobile phones and that this use was efficient and valuable in various situations. All students were well acquainted with this "service" and therefore did not "stretch its limits" or "experiment" with its capabilities. The use was straight forward, such as contacting the other group, short messages, simple discussions and coordination of activities. Another valuable use was to serve as a backup communication channel in situations where the audio contact in NetMeeting or the videoconferencing system broke down.

General Reflections on the Use of Services

E-mail, and in the second pilot project also mobile phones, can be characterized as simple services with practically no technical noise. Given proper configuration and management of the network and workstations and sufficient training and experience in use of the services, it should be possible to remove the noise from the other services as well. This would probably have a significant impact on the combined use of the communication services. Earlier field studies show that it can take considerable time to develop new use patterns and exploit the full potential of a new service (e.g., Grudin & Palen, 1995; Line, 1998, Munkvold, 1999).

Evaluation of the Process

In the following, the work process during the projects and the final results presented by the students are evaluated. This evaluation is based on the experience reports, the post survey in the second conduct and subsequent discussions with the students. Unless explicitly mentioned, the evaluation is based on both pilot projects.

Organization of the Projects

The groups chose a flat structure with no formal leader. Most of the groups appointed a contact person responsible for coordinating the activities at each site. Coordination and finding time for synchronous sessions were reported as issues in both conducts of the project. In the second project, most of the groups acknowledged this responsibility and made clear appointments. Meetings including all group members were more used in the second conduct. Few groups appointed a meeting leader, but several reported a need for this.

In the second conduct most of the groups started with a division into subtasks and a relatively strong assignment of tasks. This assignment was mostly based on an evaluation of fair division of workload. Most groups appointed a web master.

Conflicts

The overall picture is that the conflict level was very low. Consensus was normally reached by e-mail discussions, NetMeetings or by phone calls. The main sources for the few escalated and surfaced conflicts we observed were:

Broken appointments (in many cases due to unclear agreements)
Lack of responsibility and commitment to assigned tasks
"Us - them" issues

The conflict level in the two co-located groups comprising students from only one class was higher than in the distributed groups. Although we cannot draw any firm conclusions, the material from the two projects shows no indications of a raised conflict level or difficulties in solving potential conflicts in a distributed work setting.

We expected that the different professional perspectives in the two study programmes could be a potential source of conflict. Several differences, misunderstandings and potential conflicts were reported. However, these comments are outweighed by positive statements of how the students found it interesting and instructive to meet and work with people taking on a different approach to the assignment.

Efficiency

The general feedback is that the efficiency of the work was experienced as acceptable, but slightly reduced by the distributed setting. When measured against the students' expectations as expressed in the pre survey, the post survey indicates that the students experienced slightly higher efficiency impact than expected. The main cause of efficiency loss was technical noise and lack of experience with this way of working. The initial meeting at the kick-off seminar was also reported by most groups to be important for the communication in the distributed project period.

Quality of Outcome

In the first conduct of the project most of the groups were not content with the quality of the final product. The open ended and complex assignment together with technical noise with the communication services were stated as reasons for this. This is also in line with our evaluation of the project reports. Only two groups managed to compare the products using a common terminology. The rest of the groups mostly described "their" product using the vendor's terms.

For the second pilot project the assignment was made simpler and more specified. In this conduct the majority of the students were content with the quality of the group's work. Approximately 50% of the students thought the group's result would have been better if the group had been co-located during the project. None of them refer to specific problems that affected the quality. The general response is that communication would have been easier in a co-located context. Our evaluation of these reports is that all groups have answered all questions and managed to deliver a common product. We noted that several of the groups had closed important questions early, such as selection of products to compare and framework for comparison, without consulting the supervisors first.

Satisfaction with Learning Experience

The general picture is positive. The projects were characterized as interesting and instructive and the students claim to have achieved a better understanding of possibilities and limitations with distributed collaboration. In the first conduct, the students reported that the project was very demanding, both with respect to the complexity of the assignment and the total time spent on the project.

Technical noise was reported to be a source of frustration. On the other hand, we also have statements where experimenting with the communication services was regarded as an integrated objective in the project.

As can be expected, the ICT students participating in co-located groups reported less positive experiences than the rest. The "faked distributed setting felt unnatural, and they did not get the right experience of being dependent on the communication services.

Half of the students reported that they would have preferred to travel for working face-to-face, if given the resources. On the other hand, the survey shows that the students found working in a distributed team to be satisfactory. In other words, distributed collaboration is not their first choice, but they do not regard it as a major barrier either. In many ways, these statements are in line with the learning objectives of the projects, i.e. to give the students a balanced understanding of the potential and limitations of distributed collaborative work.

CONCLUSION AND IMPLICATIONS

The two pilot projects presented in this study illustrate how practical training in distributed collaboration can constitute an important part of the curriculum in graduate IS/ICT programmes. The students report a high learning outcome and perceived benefit from participating in this type of project. Task definitions and balancing of motivational factors were found to have a great impact on the groups' efforts, sharing of workload and final outcome. Further, the projects also illustrate how technical noise and lack of experience with the technologies have represented barriers to effective collaboration, implying a need for training the students in integrated use of different communication services.

The study provides a valuable experience base for planning similar student projects in the future. In the following, the major implications for conducting this type of project are summarized. In addition, we discuss some implications for practice that can be inferred from our results. Finally, although the focus of this study has been on building practical experience on training students in distributed collaboration, we also present some suggestions for further research related to distributed collaboration in general.

Implications for Training in Distributed Collaboration

Several implications can be drawn from the two pilot projects regarding design and conduct of this type of project:

Group composition
The experiences from the two pilot projects imply that the ideal group size would be two participants from each course. More than four members may result in "free-riding, and also represents a limitation when using tools like NetMeeting. In larger courses with a large number of groups, the topics for the assignment can be duplicated if necessary.

The distributed context needs to be "real"
The problems experienced by the two co-located groups in the second pilot project, illustrate the difficulty of "simulating" distributed collaborative work. Without real geographical dispersion, it is difficult for the students to restrict their communication to using electronic media only, when other group members are available for face-to-face contact next door, or even in the same PC lab.

Selection of tasks
In projects comprising members from different courses, it is vital that the nature of the task is cohesive, in the sense that it does not stimulate factions or polarization. Thus, tasks with an inherent "us-them" nature should be avoided. To reduce the students' uncertainty and enable them to quickly get started on the project collaboration, having a well-defined task seems appropriate. However, this needs to be balanced against the important learning process that may take place through "frustration" and problems related to project definition and delimitation of focus. Examples of tasks considered to be well suited are design of a simple software application, product evaluation (with no students perceiving any "ownership" of the products to be evaluated), or analysis of a collaboration problem and development of suggestions for technology support.

Scheduling of the project
The exposure of knowledge to "strangers, plenary presentation and grading of the project all constitute strong motivational factors. Thus the students may easily end up using more time on the project than allocated. As illustrated by the first of the pilot projects, this may especially be the case if the task is equivocal in nature. The duration of the project period therefore needs to be adapted to the nature and complexity of the task, and the time available for the students to work on this. In general, initial hands-on training in the use of the different communication technologies will enable the student groups to arrive at a functional stage earlier. Further, both projects illustrate that finding time for synchronous meetings may be difficult. This can be eased somewhat by coordinating the course schedules for the different student groups. However, it is important that the students remain responsible for scheduling and coordinating the meeting activities.

Establishing a common level of technical skills prior to the project
A common platform needs to be established regarding basic skills in use of the technologies to be deployed. This may for example include practical training in the use of NetMeeting prior to the project. Although it is important that the students themselves discuss and develop routines for coordination of the work and use of the technologies, we recommend presenting some "practical advice" at the outset on how to effectively deploy the technologies in distributed project work.

The students should be given the possibility for an initial face-to-face meeting
The students reported that they perceived the initial face-to-face contact during the kick-off seminar to be of great importance for building relations, and believed this to have significant influence on the process and quality of outcome of the teamwork. If possible, we therefore recommend that the students be given this opportunity. This also seems to fit well with the practice that can be observed in "real" projects, where face-to-face meetings are given priority in

the early stages of a project. From a research perspective it could here also be possible to apply a design where half of the groups are given the opportunity to meet face-to-face for the first seminar, then comparing the process and outcome for these groups with groups not given this opportunity. However, this may introduce problems in grading the projects for the two categories.

Balancing of motivational aspects
To avoid any bias in motivation and efforts for students from different courses, the evaluation form and incentives should be made as equal as possible. This includes grading and credits given for the assignment in each course.

Use remote supervision when needed
One supervisor should be assigned per group, regardless of geographical location. Technologies for supporting distributed collaboration should be applied for remote supervision when needed. This may also add to the students' experience from the project.

Experience reports may stimulate the students' reflection on the work process
By making experience reports part of the mandatory assignment, the students are stimulated to also reflect upon process aspects of the project work. However, it is important to have the groups assign a person responsible for keeping an activity log related to this, or else this may run the risk of getting low priority compared to the other project work. Further, the expected contents of these reports should be stated explicitly at the outset.

Implications for Practice

The setting created for these pilot projects is not far from work situations the students can expect to meet in their working life. However, we advocate caution in transferring results from an educational setting to a "real organization. We therefore only discuss some experiences that corroborate results from earlier field studies conducted in a real setting (Line, 1999a).

Application sharing can be an efficient tool to support discussions related to various information objects like drawings and reports. The audio quality is still not sufficient for using NetMeeting as a standalone conferencing tool. This can be solved by using conferencing phones for the audio communication part.

"Collaboration across distance demands competence and training to be efficient. This statement from one of the experience reports underpins the need to establish procedures and structures for efficient use of the various technologies. Training in basic skills is critical in order to establish the right motivation for use. Without "hands-on" experience, very few are able to relate to and see the potential benefit of technologies like application sharing and document repositories. Although there exist studies that can be seen as a first approach towards establishing best practice in this area (e.g., Mark et al., 1999), it is however difficult to define context free guidelines. The individual organization must develop its own procedures and use patterns based on its needs and accumulated experience (Line, 1999b; Munkvold, 1999).

Implications for Further Research

There still exists little research on distributed collaboration that focuses on efficient, combined use of several collaborative technologies or services. We argue that there is a need for studies applying a holistic view on communication needs in distributed projects, looking into interdependencies and interplay among several services that together may constitute an infrastructure for distributed collaboration. This is accentuated by the rapid development of Mobile Internet services based on technologies like WAP, UMTS and Bluetooth, and is also exemplified by the new role taken by mobile phones as a supporting service in the second pilot project. A holistic view considering possibilities and limitations for integration and interoperability of different technologies and services is therefore necessary for understanding how new, efficient use patterns can be developed.

REFERENCES

Ashby, R., Forsythe, C., Benavides, G., Diegert, K., Jones, R., Longcope, D. & Parratt, S. (1995). A' (A-PRIMED): A Case Study in Teamwork. *Proceedings of the Concurrent Engineering 1995 Conference*, Virginia, pp. 173-183.

Bandi, R. & Nakatani, K. (1998). Web-Based Distance Learning: Choosing Effective Technologies for Information Systems Courses. *Proceedings of the 13th Annual Conference of the International Academy for Information Management*, Helsinki, pp. 90-99.

Beranek, P.M. & Loch, K.D. (1999). Collaborative Technologies: Insight from the Classroom Experience. *Journal of Informatics Education and Research*, (1:1), 13-22.

Brandon, D.P. & Hollingshead, A.B. (1999). Collaborative Learning and Computer-Supported Groups. *Communication Education*, (48:2), 109-126.

Cohen, S.G. (1993). New Approaches to Teams and Teamwork. In J.R. Galbraith & E.E. Lawler III (eds.), *Organizing for the Future. The New Logic for Managing Complex Organizations*. Jossey-Bass Publishers, San Francisco, pp. 194-226.

Davidow, W.H. & Malone, M.S. (1992). *The Virtual Corporation. Structuring and Revitalizing the Corporation for the 21st Century*. HarperBusiness, New York.

Dede, C. (1996). Emerging Technologies in Distance Education for Business. *Journal of Education for Business*,
(71:4), 197-204.

Dufner, D., Kwon, O. & Hadidi, R. (1999). WEB-CCAT: A Collaborative Learning Environment for Geographically Distributed Information Technology Students and Working Professionals. *Communications of the Association for Information Systems*, (1:12). Available online from: http://cais.aisnet.org/articles/1-12/article.htm [01.05.00]

Fjuk, A. (1998). Computer Support for Distributed Collaborative Learning. Exploring a Complex Problem Area. *Dr.Scient. thesis 5*, Department of Informatics, University of Oslo, Norway.

Grudin, J. & Palen, L. (1995). Why Groupware Succeeds: Discretion or Mandate?. In H. Marmolin et al. (eds.), *Proceedings of ECSCW '95*, Kluwer, Dordrecht, pp. 263-278.

Hiltz, S.R. & Turoff, M. (1978). *The Network Nation: Human Communication via Computer*. Addison-Wesley, Reading, MA.

Keen, P.G.W. (1991). *Shaping the Future. Business Design through Information Technology*. Harvard Business School Press, Boston.

Knoll, K. & Jarvenpaa, S.L. (1998). Working Together in Global Virtual Teams. In Igbaria, M. & Tan, M. (eds.), *The Virtual Workplace*. Idea Group Publishing, Hershey, pp. 2-23.

Lee, A.S. (1994). Electronic Mail as a Medium for Rich Communication: An Empirical Investigation Using Hermeneutic Interpretation. *MIS Quarterly*, June 1994, 143-157.

Line, L. (1999a). Distributed engineering groups; Technological and organisational experiences from a Norwegian Consultant Company. *Dr.ing. thesis 1999:52*, The Norwegian University of Science and Technology, Trondheim. Available online from: http://ikt.hia.no/lars.line/doc/avhandling.htm [01.05.00]

Line, L. (1999b). Distributed engineering groups, practice and principles: a case study. *Working paper*. Available online from: http://ikt.hia.no/lars.line/doc/line98.htm [01.05.00]

Line, L. (1998). Application sharing - A key service for a distributed organisation. *Proceedings of CIB, W78 conference*, Stockholm, June 1998. Available online from: http://ikt.hia.no/lars.line/doc/line981.htm [01.05.00]

Lipnack, J. & Stamps, J. (1997). *Virtual Teams*. John Wiley & Sons, New York.

Mark, G., Grudin, J. & Poltrock S.E. (1999). Meeting at the Desktop: An Empirical Study of Virtual Collocated Teams. *Proceedings of the 6th European Conference on Computer Supported Cooperative Work (ECSCW'99)*, 12-16 September 1999, Copenhagen, Denmark.

McConnell, D. (1994). Managing Open Learning in Computer Supported Collaborative Learning Environments. *Studies in Higher Education*, (19:3), 341-358.

Munkvold, B.E. (1999). Challenges of IT implementation for supporting collaboration in distributed organizations. *European Journal of Information Systems* (8), 260-272.

Munkvold, B.E. (1996). An Assessment of Selected Empirical Research on Computer-Mediated Communication, Related to Distributed Teamwork in Concurrent Engineering. In M. Sobolewski and M. Fox (eds.), *Advances in Concurrent Engineering—CE96, Proceedings from the Third International Conference on Concurrent Engineering*, Toronto, Technomic, Lancaster, pp. 48-55.

O'Leary, A. & Fischer, D. (1998). Web-Based Distance Learning. *Proceedings of the 13th Annual Conference of the International Academy for Information Management*, Helsinki, pp. 85-89.

Seufert, S. & Seufert, A. (1998). Collaborative Learning Environments for Management Education. *Proceedings of the 13th Annual Conference of the International Academy for Information Management*, Helsinki, pp. 279-284.

Short, J., Williams, E. & Christie, B. (1976). *The Social Psychology of Telecommunications*. John Wiley & Sons, London.

Vitalari, N.P. (1990). Exploring The Type-D Organization: Distributed Work Arrangements, Information Technology and Organizational Design. In A.M. Jenkins et al. (eds.), *Research Issues in Information Systems - An Agenda for the 1990's*. W.C. Brown Publishers, USA, pp. 101-134.

Vreede, G.J. de, Briggs, R.O. & Santanen, E.L. (1999). Group Support Systems for Innovative Information Science Education. *Journal of Informatics Education and Research*, (1:1), 1-11.

TEACHING IS SOFT SKILLS TO A DIVERSE STUDENT POPULATION: CASE STUDIES USING JAD AND COOPERATIVE LEARNING TECHNIQUES

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ABSTRACT

It is important for Information Systems graduates to have good interpersonal and communication skills as well as technical skills. Fostering these skills in the tertiary environment is not always easy. This paper looks at a way of using Joint Application Design (JAD) and co-operative learning techniques in the classroom to promote the learning of the soft skills needed by IS graduates. An action research study was done using four case studies with the learning method being adapted between each. The study also investigated ways in which the method needed to be modified in order to deal with the diversity of students that were present in the classroom.

INTRODUCTION

> *Employers want IS graduates who can think, communicate, and work well with others. They also want individuals who have a good grounding in basic IS skills such as systems analysis and design and database concepts. These employers seem to be less interested in more specific technology skills* (Van Slyke, Kittner & Cheny, 1998, p.10).

This was the conclusion reached by these authors after research done in America to determine the needs of employers for recent Information Systems graduates.

The Information Systems '97 Curriculum (Davis, Gorgone, Couger, Feinstein & Longenecker, 1997) recognises this need for the soft skills and has communication skills and interpersonal skills as two important characteristics of an IS graduate. Communications skills include listening, negotiating, facilitation, observation and presentation skills. The skills of leadership, small group communication skills, small group organisation and working with diverse people are listed among the interpersonal skills needed.

Developing the soft skills of listening, communication, teamwork, conflict handling, debate and other interpersonal skills is difficult in a tertiary institution, especially as the learning of technical skills cannot be ignored. Group work is one way of fostering some of these skills but just putting students into groups and telling them to co-operate will not work effectively. Group work is particularly difficult in classrooms where there is a diversity of students. South Africa has a diverse population and a history of apartheid, which makes this diversity even more of a challenge. This will be described in more detail in the background section.

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This paper reports on a series of case studies done over a number of years in South Africa which looks at how the techniques of Joint Application Design (JAD), used in industry, can be brought into the classroom in order to promote the development of communication and interpersonal skills while also learning the more technical modelling tools. For this study, four case studies were done. The results of these case studies cannot be given in detail in this paper due to page constraints. An overview of what was found in each case study will be given together with a proposal for how the techniques can be used effectively.

BACKGROUND

This research took place in post-apartheid South Africa and some background is necessary to understand the context within which the research took place. There are 11 official languages in South Africa. In the Eastern Cape region, where this research was done, three languages are dominant, namely English, Xhosa and Afrikaans. The Xhosa speaking students generally come from disadvantaged backgrounds with inferior schooling. Apartheid has left South Africa with a legacy of poor schooling. Students, coming into the tertiary institutions, have often been taught by rote learning and learning from the textbook only. They find it difficult to work without a textbook or to engage in free enquiry and discussion (Ruth, 1996). While the government is trying to address this issue at secondary school level, currently these students come into tertiary institutions at a decided disadvantage. It is thus left to the tertiary institutions to help students to bridge this gap.

An additional difficulty is that the language used in most tertiary institutions in South Africa is English, which may be a student's second, or even third, language. Many of these students find it difficult to ask questions in class or to participate in discussions, especially when the whole class is present. Many are afraid that their language skills are inadequate or that their questions may be seen as naïve by the other students in the class (Goduka, 1998).

In South Africa, there are two types of tertiary institutions, namely Universities and Technikons. The Technikons, where this research was done, are career-oriented technical universities. The research was carried out at the Port Elizabeth Technikon and the Border Technikon (in East London.) The Port Elizabeth Technikon has a mixed student body with English, Afrikaans and Xhosa speakers. The Border Technikon was set up during the apartheid years to educate African students and the student body is still almost exclusively Xhosa speaking.

CASE STUDIES

The research method used has been termed 'Action Case' by Braa and Vidgen (1999). The method consists of doing a series of case studies in order to get a deep understanding of the situation using both quantitative and qualitative methods. The results of these case studies are then studied critically in order to promote change. The method thus marries the interpretive and critical approaches to research.

TABLE 1
CASE STUDIES DONE

Case Study	Year	Institution	Class-Group	Methods Used	Languages Spoken
1	1998	Port Elizabeth Technikon	IS 2	JAD only	English, Xhosa, and Arikaans
2	1999	Port Elizabeth Technikon	IS 2	JAD and coop	English, Xhosa, and Arikaans
3	1999	Border Technikon	IS 3	JAD and coop	Almost exclusively Xhosa (92%)
4	2000	Port Elizabeth Technikon	IS 2	JAD, coop and diversity	English, Xhosa, and Arikaans

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A series of four case studies was done with the method adapted after each case study. This section gives an overview of the four case studies without trying to motivate the changes made. The next section will give an indication of how the learning environment was adapted and this will be motivated using the students' comments and some of the quantitative results. Questionnaires, using both open and closed questions, were used to get a deep understanding of why the students answered as they did. An independent observer was also used to try to get more understanding of the situation.

Using Case Studies and having the researcher involved in the research limits the research in terms of generalising the results. For this reason as much context as possible has been given to allow the readers to determine whether the method developed would be appropriate in their own context.

Case Study One – 1998

The first case study was used as a pilot study for the research. It was done during 1998 with the second year Information Systems students at the Port Elizabeth Technikon. One of the authors had been using JAD techniques in her classroom for a number of years but had not really studied whether they were effective or not. The techniques of JAD were taken from industry and incorporated into the classroom in order to help the students learn about JAD and modelling techniques.

JAD, in industry, centres around a structured workshop where users from the different departments that will use a potential system are brought together with IT personnel to discuss their needs for the system. The workshop is controlled by a facilitator who keeps everyone on track, makes sure that everyone participates and that none dominate and ensures that the goals of the meeting are achieved. The facilitator is supported by a scribe, who documents the decisions taken. The meetings are structured around an agenda that is set up before the meeting. The participants must try to reach consensus about the needs of the system and any conflicts should be resolved in the meeting. These techniques and ideals were brought into the classroom where the students were given a scenario by the lecturer which they then had to model using JAD techniques and the modelling methods that they had been taught previously.

One of the lecture halls with loose desks and chairs was fitted with five whiteboards situated around the classroom. The students chose their own groups or were put into groups as they came into the classroom. The lecturer gave the students a fairly complex scenario for which they had to model the functions and the data. One of the students acted as facilitator and another as scribe. These roles were rotated to give every student a chance. More details on the results from this case study can be found in Thomas (1999a).

While the results of the case study were reasonably positive, there were some problems in the groups. Students complained about "cliques being formed, about non-participation by some and about difficulties with coping with the different languages. The students were English, Xhosa or Afrikaans speaking and had difficulties when other students would switch into a language that they could not understand. Some details of the students comments and other results are given in the next section.

Some of the problems that the students pointed out could be traced back to inadequate training on how to work effectively in groups. Other aspects could be directly attributed to the informal method of composing the groups which caused some people to feel left out of the group interaction. The subject matter was also not created to promote co-operation among the students.

In order to address these problems, co-operative learning techniques were combined with the JAD techniques and tested to see whether they did improve the situation and reduce the problems experienced by the students.

Case Study Two – 1999

During 1999, a second case study was done where some of the techniques of co-operative learning were combined with the JAD techniques. This was once again done at the Port Elizabeth Technikon with second year Information Systems students.

Co-operative learning should incorporate five principles, according to Johnson, Johnson & Smith (1991). These are positive interdependence, face-to-face interaction, individual accountability, social skills application and group processing monitoring. The circles of learning co-operative learning method was incorporated with the JAD workshop techniques, to enhance learning and promote co-operation. Knight and Bohlmeyer (1990) suggest eighteen steps that a circles of learning environment should adhere to. These are shown in Table 2.

TABLE 2
INCORPORATING CIRCLES OF LEARNING AND THE JAD METHOD

Recommended steps for circles of learning (Knight & Bohlmeyer, 1990, p.2-3.)	Implementation in JAD
Clearly specify instructional objectives.	This is done by giving the students the objectives of learning the modelling techniques as well as the objectives of learning to work with other people in small groups.
Limit the group size to no more that six with smaller size groups for students that are new to co-operative learning to ensure that everyone will participate.	Although the group sizes in the JAD sessions were sometimes eight or nine people, the use of the white boards and the roles that were played within the session allowed for easier communication and participation.
Structure groups so that they are heterogeneous with respect to ability, sex and culture.	Heterogeneous groups were used in the JAD sessions.
Arrange groups in circles to facilitate communication.	The groups were arranged in a horseshoe with the white board at the front. This facilitated good communication with the written work being done on the white board.
Use instructional materials that will promote interdependence among students.	The instructional materials (scenarios) were divided among the students so that different students were given the details of part of the system to be modelled. This was done to promote interdependence among the students.
Assign roles to ensure interdependence. One could assign a summariser-checker to summarise the lesson and quiz group members; an encourager to encourage everyone to participate; a recorder to write down group decisions and an observer to make sure that the group collaborates.	The students were given the roles of facilitator and scribe. Other students played the roles of users and IT personnel. The facilitator can be likened to the encourager and the scribe to the recorder. A summariser-checker was not needed as the lecturer played that role and an observer was not used for the second and third case studies, but was used in the fourth case study.
Explain the academic task.	The task was explained to the students.
Structure positive goal interdependence by having the group produce a single product or by providing group rewards based on the individual performances of the different group members.	The group was required to model the Use Case models and the ER models on the board for the scenarios given. No rewards were given for this.
Structure individual accountability for learning by giving individual tests or expecting the individual to explain the work.	The students were only tested individually at a later stage although the students' group processing was evaluated by their fellow team members.
Structure inter-group co-operation.	This was not done. Each group worked on their own.
Explain the criteria for success. Explain how the individual grades work and how one can earn points for one's group.	Criteria for success were determined by the group effort as well as in the individual's participation in the group. This was explained to the students.
Specify desired behaviours. These might include: Using people's names, taking turns, making sure each person understands and agrees with the group's answer.	The desired behaviours were those that were expected for a JAD session in industry. These included making sure that people reached consensus, listening with respect to others and other desirable group behaviours.
Monitor students' behaviour continually looking for problems with the task or with the collaborative effort.	The lecturer did this.
Provide task assistance. At times the teacher will need to intervene, clarify instructions, encourage discussions or even teach.	This was done to a certain extent although the lecturer tried to keep her intervention to a minimum.

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Table 2
(continued)

Recommended steps for circles of learning (Knight & Bohlmeyer, 1990, p.2-3.)	Implementation in JAD
Intervene in order to teach collaborative skills of effective communication, building a trusting environment and managing controversy.	When problems in collaboration were seen, these were pointed out to the students. They were reminded of what they had previously learnt.
Provide closure to the lesson with summaries by students and teacher.	This was not done with the class as a whole but the lecturer did it individually with each group.
Evaluate the students' work. Group or individualist incentives can be used although there should be some group incentive.	The lecturer evaluated the models of the groups and discussed any problems with the group.
Assess group functioning through ongoing observation and discussion of the group process.	The groups assessed their own group functioning using a questionnaire and the lecturer discussed any problems that they had with them.

While the levels of participation, feelings of belonging and handling of language difficulties did improve, it seemed that there were still some difficulties being experienced by the Xhosa-speaking students. They were in a minority in the class and seemed to have difficulties in stating their opinions, arguing with the other class members and often felt that, although they tried to participate, the others were ignoring them. Details on this case study can be found in Thomas (1999b). Some of the results are also given in the following section.

Xhosa speakers come from an inherently collective culture so one would not expect that they would have problems working in groups. Xhosa's use the concept of "*ubuntu* to describe humanness. This ethos is based on collectivism and is core to their culture. Goduka (1996) describes the following well-known Xhosa saying: "*Umntu ngumntu ngabantu*" or in English, "*I am we, I am because we are: We are because I am.*" This is indicative of the Xhosa culture where people work well in collective, pluralistic environments rather than in indivualistic environments. One would thus have expected that the Xhosa speaking students would have worked better in groups than their more Westernised counterparts. It was suspected that the difficulties were caused by the diversity of the students in the class and not by the Xhosa-speakers' inherent culture. It was thus decided to do a third case study using similar methods to the second case study at the Border Technikon. Border Technikon has an almost exclusively black student population in their Information Technology course. Over 90% of these students speak Xhosa with the others speaking one of the other eight indigenous languages of South Africa.

Case Study Three – 1999

The third case study was done during the second semester of 1999 at the Border Technikon. Most of the groups were 100% Xhosa speaking and the students tended to speak a mixture of Xhosa and English. They would speak Xhosa and then use English words when referring to computer terms or when referring to terms used in the scenarios. Some of the groups had students who did not understand Xhosa and these used English as the medium of discussion. The solution put onto the board was in English.

The students really enjoyed these sessions and were very enthusiastic. Their participation was good and they were overwhelming in their support for this type of activity. Many of them said that they were shy at first or that they were scared of feeling stupid at first but that they learnt a lot and felt confident later.

It seemed therefore that the problem of the Xhosa speakers did not stem from their inherent culture, but rather from the diverse student population in Port Elizabeth. This was what had been expected. Ideas for dealing with diversity, and particularly diversity in groups, were then sought in order to determine how one could deal with the problem. As one of the objectives was to get students from different cultural groups to learn to work together, we did not want to use homogeneous groups in order to solve the problem.

Case Study 4 – 2000

The last case study was done in the first semester of 2000. This was also done at the Port Elizabeth Technikon with second year Information Systems students. Some of the preparatory work was modified to make the students aware of the difficulties of communicating and working with diverse cultural groups. The composition of the groups and the way in which the groups sat was also modified. Details of these modifications appear in the next section The scribe was also asked to act as observer and to let the group know if there was a problem with their group interaction.

These changes are reflected in the method described in the following section.

JAD TECHNIQUES IN A CLASSROOM WITH DIVERSE STUDENTS

The students were divided into classes of approximately forty students each in order to facilitate the learning of these skills and to promote group work and participation. It was felt that it was too difficult to work with groups of more than a hundred when doing this type of activity.

The students were given different scenarios and asked to work together in a JAD session in order to create a Use-Case model and an entity-relationship (ER) diagram for the system.

Preparing Students for the JAD Sessions

During the first case study the students were only given a little training in running meetings and in JAD facilitation. This did not seem to be sufficient to allow the students to handle group decision making and working co-operatively. Although most of the students found it a positive experience, there were quite a lot of complaints of people who dominated the sessions and others who did not participate.

Co-operative learning literature suggests that putting students into groups and telling them to co-operate will not be effective (Johnson, Johnson & Smith, 1991). They suggest that the students should be taught some of the skills needed for co-operation before being asked to work in groups.

A series of classes was set up to allow the students to learn skills like communication skills, listening skills, group dynamics and group decision-making skills. The students were also taught about how to run problem-solving meetings. Workshop-type activities were presented to help the students to develop these skills. Student participation is imperative during these sessions in order to give the students opportunities to practise the skills. As these skills are needed for IS developers, it was felt that they could be added to the curriculum. The JAD skills of facilitation and scribing were also taught to the students. These workshops were added from the second case study onwards.

The second and third case studies had made us realise that the diversity of the students' culture placed an important role in their group processing. As one of the English-speaking students in the second case study mentioned:

> *I think that JAD is a brilliant method of educating. If the members participated it would be beneficial. South Africa still has serious racial problems and language barriers. It is sad that students can't even do mock JAD without racial conflict.*

There is some debate in the literature as to whether students should be given explicit instruction about one another's culture or not. Some authors (Bodibe, 1997; Koger, 1995) feel that students should be given such classes. Others like Goduka (1996) and Miller and Harrington (1990) argue that one should avoid a "tourist view of another's culture as this makes students more aware of in- and out-groups.

A middle road was chosen for this study. No specific instruction on different cultures was given, but while the students were doing their workshops on communications and group processing, special problems caused by diversity were highlighted. Problems that the lecturer, herself, had experienced when trying to converse in a second language were described, for example. Another example is the use of body language. The English and Afrikaans students were from a culture where one looks someone in the eye when talking to them. The Xhosa culture shows respect for a person by looking down. The idea of respecting one another's viewpoint and listening with empathy to a speaker was also emphasized.

During the fourth case study, the students were also given a workshop on being assertive. The observer in the previous case studies had noted that some of the students were passive while other tended to dominate.

Some also lacked the self-esteem to interact with the other students. The goal of the assertiveness training was to help the students to learn about having respect for themselves and others and to teach them how to act assertively.

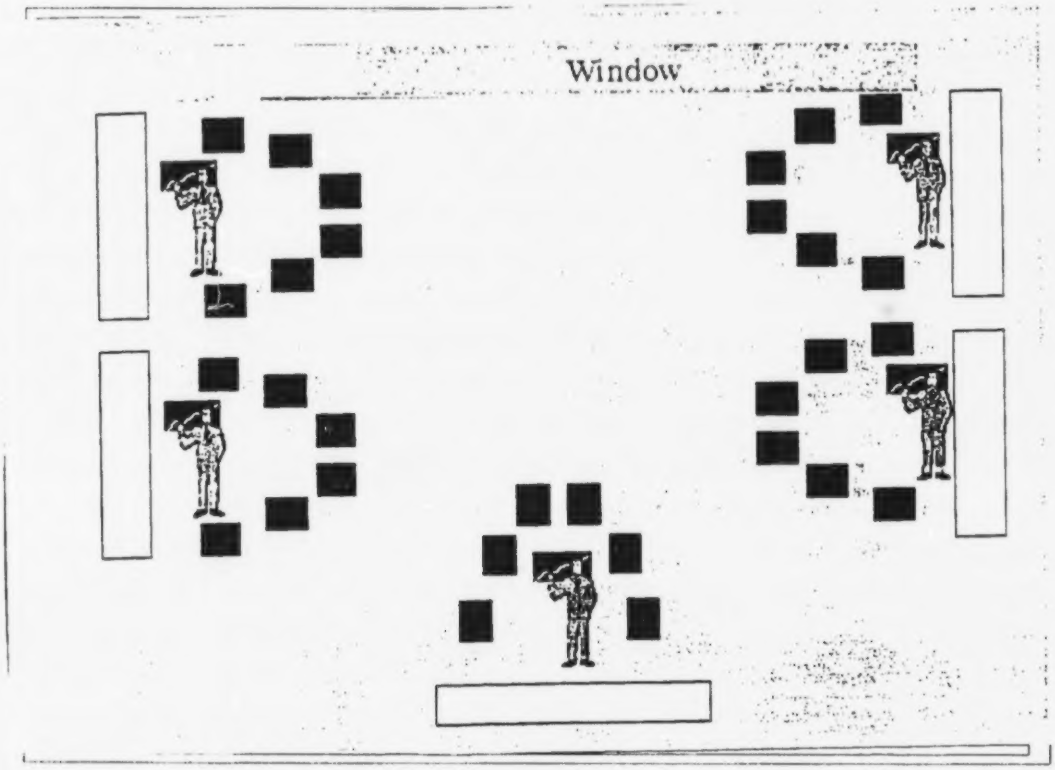
Layout of the Classroom

For the case studies in Port Elizabeth, the classroom had been set up with five white boards around the classroom and each of the five groups were assigned a board. The desks and chairs in the classroom could be moved and the students sat in the classic horseshoe shape with the facilitator at the board. This is the method suggested for JAD session in industry (Carmel, Whitaker & George, 1993). The horseshoe shape allows all the students to see one another and the board, thus promoting effective communication. The layout of the classroom is shown in Figure 1. The person standing at the board is a student, not the lecturer, who acts as the facilitator.

In the third case study, the Border Technikon did not have any classrooms with this facility. Flipchart paper was stuck to the walls and the students used this instead of a white board. While the white board was more effective, as it allowed for easier modification of the models, the paper did not give the students too many difficulties and most groups did not have to do entire rewrites.

During the fourth case study the observer noted, during the first session, that the students who sat next to their friends tended to hold private conversations with one another. One of the suggestions for JAD workshops is that the IT developers and users mingle around the horseshoe shape and do not sit next to each other as this helps to reduce private conversations and promote group cohesion. From the second session, the students were asked to move and mingle. This did seem to reduce the private conversations.

FIGURE 1
LAYOUT OF THE CLASSROOM



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Group Composition

During the first case study, the students had been allowed to form their own groups as they came into the classroom. This meant that students usually tried to form groups with their friends. As the later students came into the classroom, they would be put into the groups with the fewest number of students. This method caused a number of problems and the students often felt that they were not accepted or that the others were forming "cliques . Language was also found to be a problem during the first case study. What would often happen would be that one particular language group would get into a group, for example, Afrikaans speakers. As the late comers arrived, the lecturer would add them to the group that had the fewest people and one would end up with a majority of Afrikaans speakers and one or two English or Xhosa speakers. As the majority of the group spoke Afrikaans, they would automatically switch to speaking their home language and the others would not understand them. This caused some friction within the group. As one of the students, commenting on what they disliked about working in groups, said:

> *It was always difficult for me because we were forming our own groups, so if you don't have those friends who know you, you struggle a lot.*

It was decided to borrow from the ideas of co-operative learning for the formation of the groups for the second case study. Jaques (1991) suggests that the ideal group size for co-operative learning is six as this allows for diverse ideas while still promoting the idea that everyone needs to participate. He suggests that the group should be structured in some way if it is larger than this. As the classroom had only five white boards, the students had to be divided into five groups which meant that the group sizes were normally about eight. This was not seen as a problem as the groups were structured and the use of the white boards does facilitate better communication within the group.

There is some debate in the co-operative learning literature about the use of heterogeneous versus homogeneous groups with respect to academic ability, race and sex. As it was felt that getting the opportunity to work with people different from themselves was important, it was decided to use the heterogeneous approach.

During the second case study, it was decided to create heterogeneous groups with respect to the students' knowledge of different business areas that would be modelled, their academic ability and their home language. The business areas were chosen to get a wide spectrum of students within the groups; for example, a free clinic, a health club, and a library were used. Students from different language groups were grouped together but the students had to use English as their medium of communication as that was the only language understood by all as well as being the language that they would have to use later when moving into industry.

This method of dividing the students into groups did seem to be effective. None of the students in the second case study complained about feeling left out or about "cliques being formed. The quantitative results (shown in Table 3) also show a marked improvement in the students' perceptions of their own contribution, the contribution of others and their acceptance within the group. The students also felt that they were more able to have their say in the groups.

The students' comments were mostly positive in the open-ended parts of the questions in Case Study 2 and they mentioned that people listened to them and that they were able to discuss their different points of view. They seemed to enjoy working with other people and hearing their ideas. They also enjoyed working as a team. There were still quite a lot of problems with people who did not contribute, however. There were also ten students who mentioned that they disliked it when others disregarded their suggestions. Upon further investigation, it was found that eight of these ten students were Xhosa speakers. This was disturbing. The observer also noted that the Xhosa-speaking students tended to be marginalized.

These problems prompted us to do a third case study at Border Technikon where the Xhosa-speaking students showed no difficulties in working in groups, expressing themselves and making their opinions count even in the groups that communicated in English. As one can see by the quantitative results shown in Table 3, the participation of the students and their feelings of acceptance were also better than in the previous case studies. This led us to believe that the problems in Port Elizabeth were being caused by the diversity of the

TABLE 3
PERCEPTIONS OF CONTRIBUTION AND ACCEPTANCE ACROSS THE CASE STUDIES

		When you were a group member and not the facilitator, did you feel that the facilitators gave you a chance to have your say?	Did you feel that you were able to contribute to the group?	Did you feel that all gorup members made contributions to the group?	Did you feel accepted as a group member?
Case Study 1	Always	28,4%	21,6%	6,7%	54,7%
	Mostly	66,2%	68,9%	63,1%	38,7%
	Seldom	2,7%	9,5%	26,7%	6,6%
	Never	2,7%	0%	5,3%	0%
Case Study 2	Always	40,7%	44,7%	17,4%	71%
	Mostly	51,2%	48,2%	66,3%	22,1%
	Seldom	8,1%	7,1%	16,3%	5,7%
	Never	0%	0%	0%	1,2%
Case Study 3	Always	70%	65%	55,2%	88,3%
	Mostly	30%	35%	41,4%	11,7%
	Seldom	0%	0%	1,7%	0%
	Never	0%	0%	1,7%	0%
Case Study 4	Always	52,1%	49,5%	17,3%	83,5%
	Mostly	44,4%	47%	69,8%	16,5%
	Seldom	2,6%	3,5%	12,9%	0%
	Never	0,9%	0%	0%	0%

students rather than by the inherent cultural background of the Xhosas.

For the fourth case study, some investigation was done into the formation of groups in a diverse society. Miller and Harrington (1990) suggest that one should be careful of trying to get the ratios correct with respect to race and gender within a group as this may make the students more aware of their differences. Rosser (1998) suggests that it may be intimidating for minorities who are alone in groups and that one should try to have more than one person of that minority in a group, even if it means that other groups have no minorities in them. The groups were made as heterogeneous as possible, but there were never fewer than two people in a group who spoke the same language, were from the same racial group or sex.

Factors to promote group cohesion were incorporated into the fourth case study. For example, the students were asked to choose a name for their group. They were also told to make sure that they learnt one another's names even when they were difficult to pronounce.

The students would write their names on the one side of the board and would try to refer to one another by name. This is suggested by Bitzer and Venter (1996).

These techniques seemed to be fairly effective. As one can see the students who felt that they were always accepted in their groups went up to 83,5% with the remainder (16,5%) feeling that they were accepted most of the time. This was a distinct improvement from the first year where these figures had been 54,7% for always, 38,7% for most of the time and 6,6% for seldom.

Many of the students commented in the open-ended questions about the positive experiences that they had working with diverse people. Some of the comments made were:

> *"It helped me to learn how to interact with people of different races and cultures."*,
> *"It removed my shyness especially to different cultural groups and gender"* and
> *"It was good to work with the opposite sex, different races and coming into contact with different backgrounds."*

The first comment was made by an English-speaking, white student and the last two by Xhosa-speaking, black students.

Instructional Materials

During the first case study, the students were all given the same material. This allowed some students to sit back and not participate. In order to promote positive interdependence and individual accountability, co-operative learning techniques suggest that the study material be divided among the students in the group so that they do not all have the same material (Johnson, Johnson & Smith, 1991).

An example helps to illustrate how this aspect was dealt with during the second, third and fourth case studies. The students were asked to draw a Use-Case Model and an ER diagram for the library, for example. Instead of giving all the students the same material, only an overview was given to all the students. The rest of the material was divided among certain of the group members who were termed the "users for the session. One of the members was given the material with details of what happens at the front desk, another for the ordering of books and a third for the financial aspects of the library. As the students were put into groups based on their knowledge of the different business areas, the students with the most knowledge of a particular business area would be made a "user in that particular area. This put each of the students into the situation where they had to participate, as they were the only people with the information needed by the group. It was also more comparable to what happens in industry where the JAD sessions are meant to bring together users with different knowledge.

This seemed to have the desired effect, as shown in Table 3. The percentage of students who felt that they themselves always contributed in the group went up from 21.6% to 44.7% from the first to the second case study and then to 49,5% in the fourth case study. The percentage of those who felt that everyone else contributed went up from 6.7% in the first case study to 17.4% in the second and then stayed fairly constant at 17,3% in the fourth case study. The percentage of those who felt that the other people seldom participated went down from 26.7% in the first to 16.3% in the second and 12,9% in the last. The participation of the more homogeneous group of students during the third case study, who were almost entirely Xhosa speakers, was 65% for themselves and 55.2% for others in the always contributed categories. In other words, much higher than in the multicultural class.

Running the JAD Sessions

The students took turns at being the facilitator and the scribe. The student facilitator would stand at the board and record the design as given to him or her by the others in the group. The facilitator would also coordinate and control the session while the scribe recorded the solution and other decisions made on paper. The student facilitator was expected to make sure that all the students participated, that none dominated and that the group stayed focused on their goal. If there was conflict, then the facilitator had to help the group to reach consensus and negotiate a solution.

From the second case study, different students had different materials as they played the role of the various users of the proposed system. The facilitator had to draw this information out of the students.

The Role of the Lecturer

The role of the lecturer was NOT to solve the problems for the students, nor was it to get involved in any conflict situations. The lecturer's role was more to make sure that the JAD facilitator was doing his or her job. During the first case study, the lecturer concentrated on the modeling that the students were doing on the board, but from the second case study, she also monitored their group interaction as suggested by the co-operative learning literature.

The lecturer monitored the groups to try to determine if they were working well together as a group. If the lecturer noticed, for example, that the group tended to all talk at once without listening to each other, then she would intervene and remind them to respect one another's ideas and listen to one another. The lecturer would not act as referee, however.

At the end of the session, the lecturer would go through the groups' solutions with them and discuss any problems they might have had drawing the Use Case diagrams or the ER diagrams.

Evaluation of Group Processing

The co-operative learning literature suggests that students should evaluate their own group processing on a regular basis (Hamm & Adams, 1992). They suggest that students should be asked to determine where their group had problems and make suggestions as to what they needed to change in future. This was implemented using questionnaires from the second case study onwards. The students were asked to evaluate their group at the end of the first session; these questionnaires were consolidated by the lecturer who then gave feedback to the groups on their strengths and weaknesses. The groups were given these summaries at the start of the next class and discussed the suggestions made.

The results were not summarized quantitatively. If, for example, one student in the group found the group unfriendly, this would be pointed out to the students, even if the rest felt that the group was friendly. It was felt that this was an indication that the students were leaving out one of their group members. The lecturer might then summarize as follows:

> *While most of your group felt that the group was friendly, this was not the experience of all. Make sure that you include all your group members in your discussions.*

During the final case study the scribe was also asked to act as the observer and to let the students know if there were problems with the way in which the group was working. The students tended to find it difficult to be critical and would say that there were no problems even when the lecturer could see that there were. The use of the questionnaires seemed to be more effective in determining what problems existed in the groups. Something that one could consider would be to help the students learn about constructive criticism and how to offer constructive criticism as this might help them criticize more effectively.

Assessment

The Use Cases and ER diagrams were not given a mark by the lecturer. The solution was discussion with the students and suggestions for improving it were made, but no marks were given to the group. The groups seemed to be happy with this. The students were tested individually on their knowledge of Use Cases and ER diagrams during subsequent tests and examinations. This helped to foster the individual accountability suggested by the co-operative learning literature.

The students also gave each other a rating with respect to their participation in the group and their ability to act as facilitator. Various factors were given and the students evaluated one another on a scale of 1 to 5. This was done during the last session as it was felt that the previous sessions were for the students to gain experience. This peer evaluation was used as a small part of the grade for the students.

LEARNING IN THE JAD SESSIONS

The students from all three case studies felt that they had learnt. From the first case study, the students commented on how the method helped them to think and understand the work better and how it helped them to hear other people's opinions. As one student said,

> *It made one think and also consider another's point of view. The solution was seen through different angles.*

Another commented:

> *The interaction, as well as arguing with other group members, really broadened your way of thought.*

TABLE 4
LEARNING GROUPS

		Did you feel that the JAD techniques used in the classroom were effective in helping you to learn?	Do you feel that the JAD technique has helped you to learn how to feel more confident about how to act within a group?	Do you feel that the JAD technique has helped you to learn to interact with other people?	Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?
Case Study 2	**Already knew**	3,5%	18,6%	26,7%	22,1%
	Helped a lot	60,5%	48,8%	36%	46,5%
	Helped a little	32,6%	26,7%	31,4%	26,7%
	Did not help at all	3,5%	5,8%	5,8%	4,7%
Case Study 3	**Already knew**	6,9%	14,3%	16,7%	24,1%
	Helped a lot	91,4%	82,1%	77,8%	72,4%
	Helped a little	1,7%	3,6%	5,6%	3,5%
	Did not help at all	0%	0%	0%	0%
Case Study 4	**Already knew**	6,1%	21,4%	20%	27,2%
	Helped a lot	63,2%	58,1%	49,6%	42,1%
	Helped a little	29,8%	19,7%	27,8%	29,8%
	Did not help at all	0,9%	2,6%	2,6%	0,9%

The students marks improved by approximately 9% in Case Study 2 and 8% in Case Study 4 from their test on the modeling techniques that took place before the JAD sessions and their examination on the modeling techniques that took place afterwards. (While a t-test found the results to be highly significant, no methods of keeping the students from learning by any othermethods were used which is why no statistical results are given and it is left to the reader to decide if the results are significant.)

Table 4 gives an indication of the quantitative results showing how the students experienced what they had learnt during the sessions from Case Study 2 to Case Study 4. As the questions were modified between the first and second case studies no comparison of results is possible. Note that one must be careful of saying that the method improved between Case Study 2 and 3 as this was done with two totally different groups of students with different backgrounds. The students from Port Elizabeth Technikon had been previously exposed to quite a lot of group work in their other subjects, whereas those from Border Technikon had not.

It is interesting to note that the students' perception of their learning of how to act in a group and how to interact with others, improved between Case Study 2 and Case Study 4 both done at the Port Elizabeth Technikon. Those who felt that they had learnt a lot about how to act in a group increased from 48,8% to 58,1%. Those who felt that it helped a lot to learn about interacting with other people went from 36% in Case Study 2 to 49,6% in Case Study 4. It seems that, in dealing with the diversity issue, which we had hoped would help with the students' feelings of acceptance and contribution in the groups, we had also helped the students to learn more effectively how to act in a group and how to interact with others.

The students perceptions about their learning to work in groups, interacting with people and speaking in small groups are important as confidence has a lot to do with this ability. Many of the students commented on how it helped them to hear other people's opinions or made them think better.

On the soft skills side people spoke of how they felt less intimidated about sharing their ideas and how it helped them to realize that they should listen to other people. Many felt that it had helped them to overcome their shyness. Some comments made by some of these students include:

> *It is difficult to start talking among strangers but this helped me see that in order to do the work, you must forget other things like what people think*;
>
> *When I worked in groups before I used to be shy or find that my ideas were not used because I would not say them out loud*;
>
> *It made me realize that anyone can speak their mind, no matter who they are*;
>
> *It was a wake-up call for me to actually see what talking in front of people was all about.*
>
> One of the students put it rather comically; he said:
>
> > *I am usually afraid of all those eyes looking at me but today I am not afraid of all those eyes.*

CONCLUSION

The research has shown how JAD can be adapted to be effective in the classroom. The JAD workshops were modified using co-operative learning techniques and techniques for dealing with diversity to create groups where the students could learn to work with one another while also learning the modelling techniques that are so important for Information Systems.

While the research methods used limits the generalizability of the results, the context was set to allow the reader to make a decision as to whether the techniques used would be appropriate in their setting or not. Future research that might be useful would be to determine whether these methods are valid in other cultural contexts.

Many of the skills mentioned in the IS Curriculum '97 (Davis et al., 1997) can be demonstrated in the JAD sessions. Each of the students has a turn to be the facilitator and must learn about controlling groups, handling conflict situations and leadership. All the students must communicate, negotiate and learn to work with people who are different from themselves. The students also learn about the modeling techniques as they argue and debate with one another, seeing their own misconceptions and helping one another.

> *For quite some time, conventional systems development approaches have acknowledged the importance of the social element of ISD (Information Systems Development). Nevertheless, they concentrate on the technical process of systems development. They equip the developer with neither the tools, nor the knowledge, for dealing with the social processes intrinsic to ISD. Simple platitudes such as "get the support of senior management" or "involve the end user" are hardly sufficient to guide systems development. They tend to mask the social nature of ISD or portray it in simplistic ways. They do not allow developers to understand, let alone fully appreciate, the social nature of systems development* (Hirschheim & Newman, 1991, p30) (Brackets supplied.).

This criticism can also be levelled at tertiary institutions. Most systems development life cycles taught in Information Systems curricula include the need to involve users and seek their support. The students are, however, never given the opportunity to practise the skills that they will need in order to do this. Using JAD and other active learning techniques can help the IS student to develop the interpersonal skills and communication skills that are so important to the Information Systems development process.

REFERENCES

Bitzer, E. & Venter, K. (1996) Cultural diversity on campus: A community of learners perspective, In Bitzer E.M. (Ed) *Perspectives on multiculturality*, Bloemfontein: University of Orange Free State, pp14-24.

Bodibe, R.C. (1997) Unity within diversity: A move from rhetoric to reality, *Post Conference Proceedings of a multicultural conference*, Bloemfontein: Academic Development Bureau, University of the Free State, pp19-25.

Braa, K. & Vidgen, R. (1999) Interpretation, intervention and reduction in the organizational laboratory: a framework for in-context information systems research, *Accounting, Management and Information Technology*, 9, pp25-47.

Carmel, E., Whitaker, R.D. & George, J.F. (1993) PD and Joint Application Design: A Transatlantic comparison, *Communications of the ACM*, 36(4), pp40-48.

Davis G.E., Gorgone J.T., Couger J.D. Feinstein D.L. & Longenecker H.E.(1997) IS '97 *Model curriculum and guidelines for undergraduate degree programs in Information Systems*, Association of Information Technology Professionals, Available from ACM and AITP.

Goduka, I.N. (1996) Challenges to traditionally white universities: affirming diversity in the curriculum, *South African Journal of Higher Education*, 10(1), pp27-39.

Goduka, I.N. (1998) Linguistic and cultural diversity: Implications for learning, educating and curricula transformation, *South African Journal of Higher Education*, 12(1), pp34-43.

Hamm, M. & Adams, D. (1992). *The collaborative dimensions of learning*, New Jersey, Albex Publishing Corporation.

Hirschheim, R. & Newman, M. (1991) Symbolism and information systems development: Myth, metaphor and magic, *Information Systems Research, 2(1)*, pp.29-62.

Jaques, D. (1991). *Learning in groups*. London: Clays Ltd.

Johnson, D.W., Johnson, R.T. & Smith, K.A. (1991), *Cooperative learning: Increasing college faculty instructional productivity*, ASHE-ERIC Higher Education Report No 4, Washington D.C.: The George Washington University School of Education and Human Development.

Knight, G.P. & Bohlmeyer, E.M. (1990), Cooperative learning and achievement: Methods for assessing causal mechanisms, In Sharon, S. (ed), *Cooperative learning: Theory and Research*, New York: Praeger Publishers.

Koger, A.K. (1995) Dismantling the wall: A white professor and African American students, *College Teaching*, 42(2), pp43-52.

Miller, N. & Harrington, H.J. (1990), A situational identiity perspective on cultural diversity and teamwork in the classroom, In Sharon, S. (ed), *Cooperative learning: Theory and Research*, New York: Praeger Publishers.

Rosser, S.V.(1998) Group work in science, engineering and mathematics: Consequences of ignoring gender and race, *College Teaching*, 46(3), pp82-88.

Ruth, D. (1996) Teaching at a South African University. *Teaching in Higher Education*, 1(1), pp129-133.

Thomas, T. (1999a) Using JAD in the classroom, *Proceedings of the SACLA Conference*, Golden Gate, June 1999, pp 103-108

Thomas, T. (1999b) Co-operating to learn using JAD techniques, *South African Computer Journal*, No 24, pp87-94.

Van Slyke, C. Kittner, M. & Cheney, P. (1998) Skill requirements for entry-level IS graduates: A report from industry, *Journal of Information Systems Education, Winter 1998*, pp7-11.

ELECTRONIC AND NON-ELECTRONIC COMMERCE: A FRAMEWORK FOR CHOOSING DEMAND MODELS

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ABSTRACT

With electronic commerce exponentially increasing, it has become important to understand how to effectively market to On-line and offline consumers. This paper examines which demand model is most appropriately used in electronic and non-electronic commerce for different combinations of business and individual transactions. A framework is developed to characterize which demand model, push or pull, is best suited for successful implementation of marketing strategy based on the type of transaction in electronic and non-electronic commerce.

INTRODUCTION

In the past few years, Internet activity has increased at an astounding rate (Berthon, Pitt, & Watson 1996; Wigand & Benjamin 1995; The Big Picture Geographics 2000). Serving as a communication vehicle, the Internet now provides people with information ranging from the price of various computer parts, to books available for sale, to stock market activity. Because of the wide variety of available information, millions of people are now going on-line and surfing the Web. For companies, these people are all potential customers, and as a result, many companies and entrepreneurs have designed Web sites to sell their products and services to these consumers. With the emergence of the Internet as a dynamic medium for mediating transactions between individuals and businesses, the virtual marketplace has become a major focus for marketers. It has provided marketers with the opportunity to channel advertisements and information directly to consumers and to reduce advertising costs for the business (Hoffman & Novak 1996).

In marketing, a primary focus is the exchange relationship (Hunt 1983). This relationship consists of three participants, buyers, sellers, and intermediaries (Gebauer & Scharf 1999). The roles of the parties involved and the methods of exchange they employ depend on a number of factors. This paper focuses on two of these factors. First, transactions in electronic and non-electronic commerce involve different combinations of businesses and individuals. This paper focuses on the following types of transactions: business to business, business to individual, and individual to individual. A second factor that is vital to a seller's marketing strategy is the choice between the two demand driven models, the push and pull marketing models. Therefore, we will also examine which of the demand models is more appropriate for electronic and non-electronic commerce for the different combinations of business and individual transactions. In the next section, we will conduct a brief literature review.

BACKGROUND

Bagozzi (1974 p.78) defined an exchange system as a "set of social actors, their relationships to each other, and the endogenous and exogenous variables affecting the behavior of the social actors in those relationships." The actors involved in the exchange process include salespeople, retailers, consumers, and marketers (Bagozzi 1975, 1974; Dwyer, Schurr, & Oh 1987; Morgan & Hunt 1994; Sheth & Parvatiyar1995). A common form of social exchange is business transactions. A business transaction is a process to exchange goods or services for some form of compensation (Gebauer & Scharl 1999). Transactions usually involve three categories of participants: buyers, sellers, and intermediaries. In a transaction, buyers and sellers play an active role because they exchange goods and services for compensation. Intermediaries offer a variety of services that facilitate and/or support the buyers and sellers (Gebauer & Scharl 1999).

Following Gebauer and Scharl (1999), there are four stages in a transaction: information, negotiation, settlement, and after-sales and transaction analysis. In this paper, we are interested in the first stage in which both buyers and sellers are interested in searching for and gathering information (Gebauer and Scharl 1999). More specifically, buyers locate sources such as Web sites, magazines, and knowledgeable individuals to provide them with relevant and useful information necessary in making a purchase decision. Sellers also search for information. They are interested in where buyers go to collect information about products/ services, what qualities in a product/service are most important to the buyer, how buyers come to a final purchase decision, from where buyers prefer to purchase, i.e., electronic commerce or traditional commerce, and why. Once marketers have determined answers to such questions, they employ push and/or pull marketing models.

The two primary demand models used in information exchange are the push and pull models (Ho 2000; Kalakota & Whinston 1997; Obendorf 1997). These models are opposing methods for sending information to consumers (Oberndorf 1997). In the push model, businesses strive to "get in the face" of the consumer. This might involve businesses sending unsolicited mail to the homes and businesses of consumers. Further, more recently information technology can enable marketers to go directly to the consumers' desktops, e.g., PointCast Inc. (Wagner 1997). Contrasting this, pull models are consumer-driven and controlled; thus, it is the consumer who decides that he/she wants to gather information (Katakota & Whinston 1997). So for example, an individual may decide to look at what other individuals are selling in newspaper advertisements.

FRAMEWORK

To facilitate the examination of these phenomena, a framework for analyzing the two forms of commerce and the three types of transactions was developed. The framework presents six cells in which the push and/or pull marketing model(s) are used the most.

Forms of Commerce/Types of Transactions	Electronic Commerce	Non-Electronic
Business to Business		
Business to Individual		
Individual to Individual		

The first dimension focuses on the two forms of commerce, electronic commerce and non-electronic commerce. In the former, consumers are able to purchase goods and services over the Internet.

As the Internet continues to expand at a rapid rate, more and more companies and individuals are choosing to conduct business via this medium. Thus, it is becoming increasingly important for those who wish to sell products or services over the Internet to be aware of the methods of exchange that complement consumers' purchasing behavior. This awareness will enable companies and individuals to sell their products and services more successfully over the Internet. In the traditional form of commerce, consumers purchase goods and service in physical space: in stores at the mail, at the convenience store down the read through newspaper advertisements, and at establishments located downtown. Because of the Internet's increasing popularity, if these businesses hope to remain competitive using traditional channels, it is essential that they clearly understand how to sell to consumers in non-electronic conditions. Thus, even companies that do not sell their products and services over the Internet also need to understand consumers' behavior regarding the push and pull marketing models and which method of information gathering is more successful in non-electronic commerce.

The second dimension of the framework focuses on the different types of transactions that occur in commerce. As previously indicated, these transactions include business to business, business to individual, and individual to individual. Presently, the number of business to business transactions over the Internet is skyrocketing. In 1999, business to business transactions reached approximately $109 billion. This figure is expected to reach approximately $2.7 trillion by the year 2004 (King 2000). Therefore, it is not surprising that business to business transactions are outperforming business to individual on-line transactions(Markets Advertising: Web Ads Take a B2B Approach 2000). A business to business transaction occurs when two businesses are involved in the exchange process. For example, Safeway may purchase goods from Pepsi-Cola. A business to individual transaction involves an individual purchasing products from a business. Most people are familiar with this type of transaction. For example, an individual purchases a bottle of Pepsi from Safeway. Finally, individual to individual transactions occur when one individual sells a good or service to another individual. For example, individuals often sell goods to others at garage sales or flea markets.

ELECTRONIC COMMERCE

The popularity of electronic commerce has grown at a phenomenal rate (The Big Picture Geographics 2000). In fact, by the year 2002, it is estimated that there will be 490 million people worldwide who are accessing the Internet. Further, the top fifteen nations in Internet use will account for 82% of all the users. This growth may be in part due to the benefits electronic commerce provides consumers, such as perceived convenience, information, and fewer hassles. As well, marketers have also benefitted because they can now make quick adjustments to market conditions, lower costs, increase audience size, and build relationships (Kotler 1999). Previous research (e.g. Ellsworth & Ellsworth 1997; Komenar 1997) has indicated that businesses that use the Internet as a medium for commerce rely on the pull marketing models for two primary reasons. First, some researchers (e.g., Berthon, Pitt, & Watson 1996; Ellsworth and Ellsworth 1997; Kotler 1999) believe that a business must bring its audience to its site, convince them to stay, and later have them return. Thus, the exchange process is customer initiated and controlled, i.e., the consumer, not the marketer, is in control of the interaction. A company has limited control over the number of potential consumers it attracts to its site. Second, new trends have emerged that negatively impact non-electronic commerce that uses push marketing models (Komenar 1997). More specifically, the increase in competition and consumers' expectations and the decrease in the effectiveness of the mass media suggest that companies must find new means to differentiate themselves from the competition while still fulfilling consumer's increasing needs and wants. Companies that use the Internet to provide a new medium to transfer information directly need to employ different strategies in selling goods and services.

Although it is true that companies have to entice consumers to visit their Web sites, this is nothing new for companies involved in non-electronic commerce. For years, businesses and individuals in non-electronic commerce have been trying to find ways to encourage consumers to visit their establishments. Thus, almost any company that wants to sell a product needs to inform consumers that it exists. Non-electronic commerce has relied on media such as television, radio, magazines, newspapers, and billboards to promote brands or products. Recently, electronic commerce has begun to do the same. Companies on the Internet also push their marketing through other sources besides the Internet to increase consumer awareness to sell their products. For example, during the Super Bowl, several of the commercials aired and sponsors of the event were Internet companies. The visibility they achieved during this four hour broadcast may have been more effective than advertising on the Internet. Marketers are also finding other ways to advertise without having consumers first visit their Web site. Marketers now place advertisements on other Web sites, participate in forums and newsgroups, and send e-mails to potential consumers about the company's products/services and specials (Kotler 1999).

Regarding the negative trends that impact non-electronic commerce, companies on the Internet can overcome some of these trends. As the amount of available information continues to increase at a rapid rate, the search for and identification of relevant and useful information is becoming time consuming and difficult for the consumer. Thus, there has been a growing consumer preference for channels that automatically customize information to meet their wants and needs (Li, Kuo, & Russell 1999). On-line marketers are now having consumers sign-up to receive information via e-mail about products and services that are of particular interest to the consumer. For example, in business to individual transactions, if a consumer is interested in a certain technology, once the consumer provides the company with an e-mail address, the company can periodically e-mail the consumer information about this technology. In business to business transactions, businesses may also reach agreements so that the seller e-mails all relevant information to the buyer. Finally, marketers are taking advantage of new forms of technology that assist in informing consumers about products and services. One of the latest push technologies on the Internet is Webcasting. Webcasting enables on-line marketers to push and deliver advertisements and information to subscribers without the subscriber ever making a request (Kotler 1999; Mosley-Matchett 1997). Essentially, companies sip up with a Webcasting service, such as PointCast. These services will then automatically push customized information directly to the subscriber's desktop. Hence, in electronic commerce, the push model exists in two types of transactions, business to business and business to individual. Therefore, we hypothesize the following:

H1: In both business to business and business to individual transactions in electronic commerce, the seller will prefer to use a push model to sell its goods or services to the buyer more often than a pull model.

However, the pull model will be used in individual to individual interactions. Although millions of consumers go on-line everyday, the individual still has to attract and pull another individual to his/her site. To successfully attract consumers to a Web site, the seller would either need to create an attractive Web site or pay a search engine, like Yahoo! or Excite, to include his/her address in their lists of potential hits. However, for many individuals, this may require too much time and effort. Thus, many individuals have opted to sell their goods and services via intermediaries such as eBay. These intermediaries act as agents that stand between the buyers and sellers of a transaction and perform necessary functions for the fulfilment of the transaction (Kalakota & Whinston 1997). These companies attract millions of potential buyers who can see the goods that people all over the world want to sell. Thus, to a certain extent, direct individual to individual transactions in electronic commerce are disappearing as people choose to employ the assistance of companies to sell their goods. Also, as consumers become more familiar with these Websites, they may stop surfing the Web to find other individuals from whom to buy. If the intermediaries provide reliable service and have a good reputation, consumers will use the services more because not only will consumers reduce their searching time, but they may also feel more confident purchasing a good from this type of company rather than a stranger. Like other businesses on the Internet, these companies use push strategies to increase buyers' awareness of the goods and services they provide. However, presently not all of the Internet intermediaries are pushing their marketing via other media. Without this push, consumers still must surf the Internet to find the Web site. So, some of the intermediaries still rely on the pull model. Thus, one could expect that both types of models would be used in intermediary assisted individual to individual transactions. This leads to the following hypothesis:

H2a: In electronic commerce, individual to individual transactions will rely on pull supply chains to sell goods or services independently.

H2b: In individual to individual transactions that use intermediaries, either the push or the pull model may be used to sell goods or services.

NON-ELECTRONIC COMMERCE

In business to business transactions, the extent to which push and pull models are used will depend on the type of relationship that exists between the businesses involved in the transaction. With the development of technology such as EDI, strong relationships between companies have been formed. Because these companies have transactions with each other exclusively for certain products, strong relationships will rely on the pull model for marketing. However, if a relationship does not exist between the two businesses involved in the transaction, the seller will rely on the push model. This will occur because the seller will be in competition with other businesses. Thus, this increased competition will emphasize the importance for the seller to push its marketing in order to increase the awareness of its product. More formally:

H3: In non-electronic commerce, business to business transactions will depend more on the pull model when a strong relationship exists between the buyer and the seller; when this relationship does not exist, companies will use the push model.

Previous research (Kalokota and Whinston 1997; Komenar 1997) has indicated that in business to individual transactions, companies generally use the push model to sell their products. These techniques are successful in traditional marketing because it is easy for companies to "get in the face" of the a consumer. Companies have the option of numerous communication vehicles through which to market their product and brand. As mentioned above, they can use the television, radio, magazines, and billboards for marketing purposes. Therefore, we hypothesize that:

H4: In business to individual transactions, companies using non-electronic commerce will use the push model to market goods and services.

Finally, in individual to individual transactions, it may be difficult for a seller to find a potential buyer for a given product. This difficulty arises because individuals often do not have the means available to market their goods to the public independently. In this type of transaction, individuals need to rely on word-of-mouth, creative signs, and luck to sell their goods. Therefore, a pull model would be used. As in electronic commerce, individuals have the option of using businesses to help sell their goods. These businesses include such means as newspaper advertisements, radio swap and shop call-in shows, and buy and sell magazines. However, unlike the Internet, these businesses only reach a limited number of peoples. As well, these media require the pull model. Therefore, the following hypotheses have been developed:

H5a: Individual to individual transactions in non-electronic commerce will use the pull model to sell goods and services.

H5b: Individual to individual transactions in non-electronic commerce that use intermediaries to assist in a sale will rely more on the pull model than individual to individual transactions that use intermediaries in electronic commerce.

The framework for analyzing the forms of commerce and the types of transactions is completed as follows:

Forms of Commerce/ Types of Transactions	Electronic Commerce	Non-Electronic
Business to Business	Push	Pull/Push
Business to Individual	Push	Push
Individual to Individual	Push/Pull	Pull

The extent to which the choice of marketing model is successful depends on consumers' responses. This can be illustrated with the first initial attempt of business to individual transactions over the Internet. An overkill of unsolicited commercial e-mails resulted when companies employed the push model. The form of the push model was quickly viewed as an invasion of privacy and annoying for the consumer (Mosley-Matchett 1997). Companies have since responded to consumers. Although the companies still use e-mail as a major source of push marketing, the information that the companies send to consumers is that which the consumer has indicated he/she would like to receive. This improved form of push marketing has resulted in only 1% of 1,000 recipients asking to be removed from a given mailing list (Obendorf 1997).

CONCLUSION

This paper has examined the need to take the form of commerce into account when examining the success of different demand models for business transactions. The Forms of Commerce/Types of Transactions Framework has been used to characterize the demand model, push or pull, best suited for successful implementation of marketing strategies in electronic and non-electronic commerce. For example, with all the new On-line businesses emerging there may exist companies that are unsure about which demand model would most effectively communicate its information to a consumer. Thus, management could examine the framework to determine that in a business to business transaction, unlike in non-electronic commerce where either push or pull models work, in electronic commerce, a push model may be the best option. This same framework can be used to analyze other organizational strategies besides push-pull marketing demand models that examine transactions in electronic and non-electronic commerce.

Marketing is one of the central aspects of a business. It is used to inform consumers about and attract them to a company's products and services. Therefore, it is important for sellers to use the most effective demand model available in marketing strategy. The framework presented is especially beneficial to businesses and individuals who have or are deciding to sell products and/or services over the most repentant explosive medium, the Internet. For example, if businesses realize that push marketing is the more effective demand model for electronic commerce, they can use push strategies to market their products/services. This framework is also helpful for businesses that rely on traditional forms of commerce. In non-electronic commerce, business to business transactions are not restricted to push marketing. Rather, both push and pull demand models can be used to inform the consumer. The option to use either model provides non-electronic commerce flexibility in marketing strategies. A deeper understanding of the effectiveness of the demand marketing models in different types of transactions will facilitate almost any business or individual interested in selling a product and/or service. Whether the seller uses electronic or non-electronic forms of commerce, comprehending which demand model works best will assist in maximizing demand for products and services.

Our research is not without its limitations. First, this framework may not directly apply to companies that hold monopolies in the market. It is clear that companies that do not have any competition may rely on either form of marketing demand model. Second, the framework makes the assumption that people are responding favorably to marketing via the new medium, i.e., the Internet. Statistics suggest that positive responses to electronic commerce do in fact exist. For example, in the United States, there are expectations that in the next 12 months, 79% of individuals who do not currently purchase products/services over the Internet will make their first on-line purchase (Stores January 2000). Finally, we have neither tested the inherent assumptions of the theoretical framework nor its implications in an empirical fashion. However, given the importance and significance of understanding the effect of marketing strategy in both electronic and non-electronic commerce, our framework provides a positive first step.

Future research should look at the other side of the information exchange process. Understanding consumers' reactions to the use of certain demand models in the different types of transaction in both electronic and non-electronic commerce would be beneficial. By considering both the buyers and sellers, the most effective and efficient demand methods could be used.

REFERENCES

Bagozzi, R. P. (1974). "Marketing as an Organized Behavioral System of Exchange. *Journal of Marketing*, *38*, 77-81.

_____. (1975). "Marketing as Exchange. *Journal of Marketing*, *39*, 32-39.

Berthon, P., Pitt, L. F., & Watson, R. T. (1996). "The World Wide Web as an Advertising Medium: Toward an Understanding of Conversion Efficiency. *Journal of Advertising Research*, 43-54.

CyberAtlas. (2000, March). *The Big Picture Geographics: The World's On-line Populations* [On-line]. Available: http://cyberatlas.internet.com/big pictur...aphics/article/0,1323,5911 151151,00.html.

_____. (2000, March). *Markets Advertising: Web Ads Take a B2B Approach* [On-line]. Available: http://cyberatlas.internet.com/markets/advertising/article/0,1323,5941 324031.00html.

Dwyer, F. R., Schurr, P. H., & Oh, S. (1987). "Developing Buyer-Seller Relationships. *Journal of Marketing*, *51*, 11-27.

Ellsworth, J. H. & Ellsworth, M. V. (1997). *Marketing on the Internet.* New York: John Wiley & Sons, Inc.

Gebauer, J. & Scharl, A. (1999). "Between Flexibility and Automation: An Evaluation of Web Technology from a Business Perspective. *Journal of Computer-Mediated Communication* [On-line], *5*, Available: http://www.ascusc.org/jcmc/vol5/issue2/gebauer.html.

Ho, J. K. (2000). "Bridging Academic Research and Business Practice with the New Media. *Information Resources Management Journal*, 6-64.

Hoffman, D. L. & Novak, T. P. (1996). "Marketing Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing, 40*, 81-88.

Hunt, S. D. (1983). "General Theories and the Fundamental Explanada of Marketing. *Journal of Marketing, 47*, 9-17.

Kalakota, R. & Whinston, A. B. (1997). *Electronic Commerce: A Manager's Guide.* USA: Addison Wesley Longman, Inc.

King, J. (2000). "How to Do B2B. *ComputerWorld, February 28*, 48-49.

Komenar, M. (1997). "Designing Your Presence. In M. Komenar (Ed.), *Electronic Marketing: A Comprehensive Reference of Electronic Marketing Techniques to Help You Reach a Broader Market* (pp. 27-88). New York: John Wiley & Sons, Inc.

Kotler, P. (1999). *Marketing Management: The Millennium Edition.* Upper Saddle River, NJ: Prentice-Hall.

Li, H., Kuo, C., & Russell, M. G. (1999). "The Impact of Perceived Channel Utilities, Shopping Orientations, and Demographics on the Consumer's Online [sic] Shopping Behavior. *Journal of Computer-Mediated Communication* [On-line], *5*, Available: http://www.ascusc.org/jcmc/vol5/issue2/hairong.html.

Morgan, R. M. & Hunt, S. D. (1994). "The Commitment-Trust of Relationship Marketing. *Journal of Marketing, 58*, 20-38.

Mosley-Matchett, J. D. (1997). "Webcasting: It's Important to Learn Pros and Cons of Push and Pull. *Marketing News, 31*, 31-32.

Oberndorf, S. (1997). "Pushing E-mail: Catalogers combine 'Push' and 'Pull' to Sell Online [sic]. *Catálog Age, June*, 61.

Sheth, J. N. & Parvatiyar, A. (1995). "Relationship Marketing in Consumer Markets: Antecedents and Consequences. *Journal of Academy of Marketing Science, 23*, 255-271.

"Understanding the Online [sic] Consumer. (2000, January). *Stores, 82*, 11-21.

Wagner, M. (1997). "Technology Lets Web sites Get 'Pushy.' *ComputerWorld, January 6*, 55.

Wigand, R. T. & Benjamin, R. I. (1995). "Electronic Commerce: Effects on Electronic Markets. *Journal of Computer-Mediated Communication* [On-line], *1*, Available: http://www.ascusc.org/jcmc/vol1/issue3/wigand.html.

THE USE OF HYPERTEXT AND ANIMATION FOR ONLINE LEARNING

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ABSTRACT

This research examines the effect of hypertext and animation in the context of online learning. With an increasing number of online courses and degrees offered through the Internet and a rapidly increasing enrollment in such courses, it is important to assess and understand how these online features can affect or contribute toward learning. We propose and test a model to explain and predict the effect of hypertext and animation on online learning. Preliminary results of the study are reported.

INTRODUCTION

Currently, the Internet dominates in the development of information and communication technology. The Internet has taken an important role in our daily life by providing a wide range of services including entertainment, education and business. In the field of education, the Internet is used not only to supplement classroom teaching, but also as an increasingly popular medium for delivery of online education courses. An immense amount of research literature and Internet-based teaching modules are added to this network continually. These resources aim towards being a viable alternative for distance learning. According to a survey by the U.S. Department of Education, a total of more than 54,000 online education courses were offered in 1998, with 1.6 million students enrolled (Lewis et al. 1999). Such online courses continue to proliferate very quickly.

Advances in Internet technology have provided users access to not only text and graphics but also digitized audio, video signals, and animations as well. Two online features that have made the Internet more adaptable for education and learning are *Hypertext* and *Animation*.

"Hypertext" is the organization of information units into connected associations that the users can choose to relate at the click of a mouse. Hypertext has been found to be an effective method of training because it provides user flexibility and control over the method, speed, location, and order of information access (Marshall and Shipman

1995). In this way it caters to a wide range of users who have different goals, interests, requirements and comprehension abilities. Hypertext not only allows students the flexibility to access class information discretely in order to match their pace and personal requirements, but also furnishes students with a knowledge domain through which they can gain/retrieve information at their own pace to match their study order.

Research has shown that individuals comprehend information better with visualization than with written text. One of the simplest forms of visualization is "Animation". Animation refers to computerized simulation of processes using images to form a synthetic motion picture. In the context of learning, Pezdek and his colleague (Pezdek and Stevens 1984; Pezdek 1987) predict that the use of the visual mode of communication effects the human mind to have a higher grasping and retaining capability. Animation is also expected to contribute toward learning since it appeals to the power of the human visual system (Clary, 1997). In Kehoe's (1996) review of studies on animation in education, visual aids are found to have a dramatic positive effect on learning if certain conditions ("explanative text", "sensitive tests", "explanative illustrations", "inexperienced learners") are met (Mayes 1989).

The Internet and its related technologies have provided us with not only a new dimension in education, but also a wider range of teaching and learning styles. With an increasing enrollment in web-based courses and the large amount of resources invested in designing such courses, it is important to investigate how *Hypertext* and *Animation* can influence students' learning behavior and experience, and their subsequent impact on effectiveness of learning. Using the concept of *Flow* (Csikszentmihalyi and Csikszentmihalyi 1988; Hoffman and Novak 1994), we construct a model to explain the effect of hypertext and animation in the online learning environment. Empirical studies are being carried out to test this model.

FLOW THEORY AND CONCEPTS

Flow is the feeling or sensation of enjoyable experiences and the process of optimal experience (Csikszentmihalyi and Csikszentmihalyi 1988). Understanding flow is important in all disciplines and systems -- if a discipline or system can provide the users with sensation of enjoyable experiences, then the users will voluntarily gain increasingly more information from the system and take a more active role in participation. In this manner the more the users enjoy and learn from the experiences the more will be the evolution of the discipline. There have been various definitions and descriptions given to flow. One such description is (Csikszentmihalyi and Csikszentmihalyi 1988 p. 29):

> *Artists, athletes, composers, dancers, scientists and people from all walks of life, when they describe how it feels when they are doing something that is worth doing for its own sake, use terms that are interchangeable in their minutest details. This unanimity suggest that order in consciousness produces a very specific experimental state, so desirable that one wishes to replicate it as often as possible. This particular "state" is given the name "flow."*

Privette and Bundrick (1987) have defined the same term as

> *... an intrinsically enjoyable experience, is similar to both peak experience and peak performance, as it shares the enjoyment of valuing of peak experience and the behavior of peak performance. Flow per se does not imply optimal joy or performance but may include either or both.*

Challenges and skills are the universal preconditions of flow. For flow to occur, it is necessary to have a balance between the level of challenges and the level of skills possessed by an individual in a situation (Csikszentmihalyi and Csikszentmihalyi 1988), and for the flow to be sustained for long these challenges should "become more complex" (Csikszentmihalyi 1982) over time. Csikszentmihalyi (1982) uses the example of a tennis player to illustrate and support the concept of flow. According to Csikszentmihalyi, a tennis player who enjoys the game will improve his/her skills through playing tennis. Now if the challenge imposed by the opponent of this player does not increase/improve, the player will get bored and eventually lose interest unless he/she finds an opponent who offers challenges that meet the improved skills of this player.

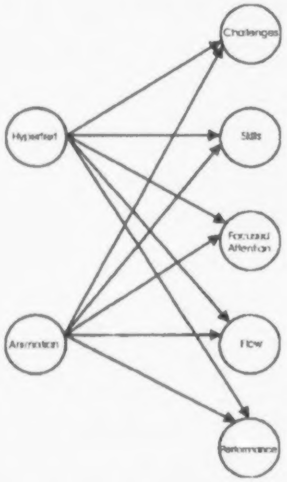
Researchers have suggested that flow is a useful construct for describing our interactions with computers (Csikszentmihalyi 1990; Ghani 1991; Ghani and Deshpande 1993; Webster, Trevino, and Ryan 1993). According to Hoffman and Novak (1994), control, content, and motivational characteristics influence four direct determinants of the Flow state: 1) Perceived congruence of skills and challenges, 2) Focused attention, 3) Interactivity, and 4) Telepresence. Their model consists of an environment having various exit points. Only perceived congruence (of skills and challenges) and focused attention are examined in this research. The "perceived congruence of skills and challenges" condition is the prerequisite for flow to occur. Once the congruence between skills and challenges is achieved, flow is initiated. It is important to note that in order to sustain this flow state, congruence should always be present. During the flow state, the user experiences enjoyable feelings. At the same time this environment stretches a user's capabilities in learning new skills and enhances his/her "self-esteem and personal complexity" (Hoffman and Novak 1994). Any disparity between skills and challenges will result in the user either exiting the activity or selecting a more congruential activity (i.e., an activity where the user perceives a balance between his/her skills and the challenges offered by the system/activity). In other words, for a system or an activity to provide flow to its users, it should be flexible enough to continually match the skills of the involved users with challenges imposed by the system/activity. The system or activity has to cater to the improving skills of the involved users as they continue using the system or performing the activity.

Focused attention is necessary to induce flow. Focused attention is defined as the "centering of attention on a limited stimulus field" (Csikszentmihalyi 1977). According to Csikszentmihalyi and Csikszentmihalyi (1988), when one is in flow, "one simply does not have enough attention left to think about anything else". The concentration is so immense that the individual does not have any thoughts of being happy or being sad or in fact anything else but the activity. The following is Csikszentmihalyi and Csikszentmihalyi's (1988) description of the flow experience of a young basketball player. While playing the game, s/he completely concentrates in it. Everything that matters to this player is the court. The player forgets or lays aside any other thoughts and feelings of problems such as fighting with his steady girl. This is due to involvement in the activity where the mind is totally concentrating in that activity. Flow can never be experienced if there is no complete involvement or concentration in an activity.

Interactivity is the availability of immediate feedback between entities. This exchange of information and feedback is in form of a sensory dialogue. It is important for an activity to be interactive to induce and maintain flow. In terms of human computer interactions, interactivity can be thought of as an activity where the user requests some action to be performed and the computer responds to that request by taking the appropriate action or displaying the results to the user. An example is that of performing a search on the web using a search engine. To carry out the search, the user will first enter the text to be searched. This text forms the input from the user to the computer. The search engine would respond to the user's request by presenting the search results to the user. The system and activity is interactive because the system output depends on the results of the search. Since our system is a "static" learning module, we will not examine interactivity in this research.

Telepresence is the feeling of being present in a place different from your immediate physical location. Such a feeling is achieved while interacting with a medium such as one involving virtual reality. As hypertext and animation are expected to produce minimal effect, if any, on telepresence, we will not include it in this research.

FIGURE 1
RESEARCH MODEL



PROPOSED MODEL

Our research question is: "How does the inclusion of hypertext and animation effect flow in the online educational environment and what are their implications on effectiveness of learning (measured by performance in a test)?" Our model will focus on the impact of hypertext and animation on skills, challenges, focused attention, flow, and test performance.

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Our model hypothesizes that:

(A) *Hypertext decreases challenges, and increases perceived skills, focused attention, flow, and effectiveness of learning (measured by test performance).*

We hypothesize that hypertext will lead to improved perceived congruence of challenges and skills by decreasing challenges in learning the domain and increasing users' perceived skills in the domain. With the availability of hypertexts that provide explanations on difficult terms, the challenge in learning the domain is decreased. Since hypertexts reduce the difficulty in learning the domain by providing explanations on difficult terms, users perceive themselves to have a higher level of skills in the domain. When learning a new or challenging domain, the perceived congruence between challenges and skills will be improved by decreasing the perceived challenges and increasing the users' perceived skills in the domain. By increasing the ease and convenience of accessing explanations on difficult terms, users are also more likely to stay focus on the learning process and in using the learning module. When perceived congruence (of challenges and skills) and focused attention are achieved, flow occurs. With greater flow and focused attention on the learning module, effectiveness of learning will improve.

(B) *Animation decreases challenges, and increases perceived skills, focused attention, flow, and effectiveness of learning (measured by test performance).*

Similarly, providing animations of the concepts covered in the learning module decreases the challenges in learning the domain and increases the users' perceived skills. Since the domain is made more interesting to learn through animations, focused attention will increase, which further leads to flow. We hypothesize that effectiveness of learning will improve by providing visualizations of difficult concepts in the domain and through increased flow and focused attention.

RESEARCH DESIGN AND METHODOLOGY

Figure 2 presents the proposed experimental design for the study. An Internet teaching module — developed for the department of Agronomy at the University of Nebraska-Lincoln — will be adapted for this experiment. The module presents the fundamentals of plant genetics and is targeted towards distance learning students in the field of Agriculture. For this experiment, we will recruit only novice subjects who have no prior knowledge of plant genetics. These subjects will be randomly assigned to one of the four experimental conditions.

FIGURE 2
EXPERIMENTAL DESIGN

	No Animation	Animation
No Hypertext		
Hypertext		

The teaching module presents basic principles of plant genetics and provides a glossary of terms in plant genetics. In the hypertext version of the module, the users only need to click on the term (or more specifically, the hypertext link associated with the term) to access explanations on the term. The explanations are presented in a small Internet browser pop-up window. All the information that is available through these hypertext links is also available in the system's "glossary document". In the non-hypertext version of the module, the users will have to separately access the "glossary document" and search for the specific term to access explanations on the term. Thus, the provision of hypertext links facilitates the search process by making the explanations more "easily accessible."

In the animated version of the teaching module, animations of various processes are presented along with the text. These animations are in addition to the regular graphics, diagrams and photographs that are embedded in the text. In the non-animated version, these processes are shown in a static manner. Thus, the use of animations provides a richer mode of communicating and expressing the textual and "static graphical" information to the users.

Study data will be collected using a questionnaire administered at the end of the study and through computer logs.

PRELIMINARY RESULTS

We analyzed the data collected using MANOVA. Interestingly, none of our hypotheses are supported. Contrary to our hypotheses, hypertext has a negative impact on the dependent variables in the study ($p<.05$) while animation does not produce any significant impact on the dependent variables. We suspect the reason may be due to the small statistical power of the study. Even with a large effect size ($f=.40$), the power attained is only .60. When analyzing at a medium effect size of $f=.25$, the power is only .28. Hence, the contrary and insignificant results may be due to Type II error. In future research, we will carry out this study with a larger sample size to assess the effect of hypertext and animation on the dependent variables proposed.

EXPECTED CONTRIBUTION

This research assesses the degree to which Hypertext and Animation contribute toward learning in the online environment. More specifically, it examines how Hypertext and Animation influence challenges, perceived skills, focused attention, flow and effectiveness of learning. From a research standpoint, this study investigates and explains how the provision of hypertext and animation impact on effectiveness of learning. From an application standpoint, the results will be extremely useful to educators, designers, and developers of web-based training courses. With an increased understanding of the effect of online features on learning, web designers and programmers can develop better and more effective online training modules by focusing their time and attention on incorporating features that contribute toward effectiveness of learning.

REFERENCES

Clary, J. (1997, Spring), "Algorithm Animation Hypertext: Today's Learning Tools", *The Spelman Science and Mathematics Journal: An Interdisciplinary Undergraduate Journal*, 1(1), available at http://www.spelman.edu/ ssmj/vol1_1/tech/clary.htm.

Csikszentmihalyi, M. (1977), *Beyond Boredom and Anxiety*, second printing. San Francisco: Jossey-Bass.

Csikszentmihalyi, M. (1982), "Towards a psychology of optimal experience", in L. Wheeler (Ed.), *Review of personality and social psychology*, (Vol. 2). Beverly Hills, CA: Sage.

Csikszentmihalyi, M. (1990), *Finding Flow: The psychology of engagement with everyday life*. BasicBooks, A division of HarperCollins publishers.

Csikszentmihalyi, M. and Csikszentmihalyi, I. (1988), *Optimal Experience: Psychological Studies of Flow in Consciousness*. Cambridge, Cambridge University Press.

Ghani, J.A. (1991), "Flow in Human-Computer Interactions: Test of a Model," in J. Carey (ed.) *Human Factors in Management Information systems: An Organizational Perspective*. Norwood, NJ: Ablex.

Ghani J.A. and Deshpande S.P. (1993), "Task Characteristics and the Experience of Optimal Flow in Human-Computer Interaction," *Journal of Psychology*, 128(4), 381-391.

Hoffman D.L. and Novak, T.P. (1994), "A Process Model of Network Navigation Within a Hypermedia CME", available at http://ecommerce.vanderbilt.edu/cme.conceptual.foundations.html.

Kehoe, C.M. (1996), "Algorithms and Animation," available at http://www.cs.gatech.edu/grads/k/Colleen.Kehoe/papers/lit_review/lit_review.html.

Lewis, L., Snow, K., Farris, E. and Levin, D. (1999, December), "Distance Education at Postsecondary Education Institutions: 1997-98", Statistical Analysis Report, National Center for Education Statistics, available at http://nces.ed.gov/pubs2000/2000013.pdf.

Marshall, C.C. and Shipman, F.M. III (1995), "Spatial Hypertext: Designing for Change," *Communications of the ACM*, 38(8), 88-97.

Mayes T.J. (1989), "The 'M-word': Multi-media Interfaces and their Role in Interactive Learning Systems," available at http://www.icbl.hw.ac.uk/ctl/mayes/paper4.html.

Pezdek, K. (1987), "Television Comprehension as an Example of Applied Research in Cognitive Psychology," in D.E. Berger, K. Pezdek & W.P. Banks (Eds.) *Applications of Cognitive Psychology: Problem Solving, Education, and Computing*. Hillsdale, N.J.: Lawrence Erlbaum.

Pezdek, K. and Stevens, E. (1984), "Children's Memory for Auditory and Visual Information on Television," *Developmental Psychology*, 20, 212-218.

Privette, G. and Bundrick, C. (1987), "Measurement of Experience: Construct and Content Validity of the Experience Questionnaire", *Perceptual and Motor Skills*, 65, 315-332.

Webster, J., Trevino, L.K. and Ryan, L. (1993), "The Dimensionality and Correlates of Flow in Human Computer-Interactions," *Computers in Human Behavior*, 9, pp. 411-426.

TECHNOLOGICAL LEAPFROGGING BY DEVELOPING COUNTRIES

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ABSTRACT

The possibility of achieving significant economic growth through technological leapfrogging seems exceptionally attractive to developing countries. It appears that the possibility of developing countries adopting advanced technology immediately, rather than proceeding by mastering intermediate technologies in turn, is dependent on the type of product (specific technology) in question, the social condition and environment of the country in question. The ideas and thoughts raised in this paper are considered preliminary, and should be tested in practical projects in developing countries that have a technologically backward setting.

INTRODUCTION

The advances in information technology have been very rapid and significant over the past decades. The cost-performance of this technology has followed a declining trend with each level of technological advancement, that it made the once "bulky and government-affordable" computer model a ubiquitous item in our workplace and lifestyle today. One of the notable technological breakthroughs in information technology is the convergence of computer technology and telecommunication technology. This has brought about a significant growth in network computing, enabling information to be processed and transmitted at unprecedented speed and time. Today, the types of network enabled by information technology vary in scope of coverage. The organisation could adopt information technology to create a framework that supports intra-organisational linkages for an integrated organisational business system. Such integrated organisational system characteristic could be extended beyond the organisation to interlinkages that involve affiliated offices, headquarters, suppliers and clients in different locations. This networking capability of information technology has brought about applications that go beyond the traditional mode of automating internal transaction process. It has already made significant impact on customer service improvement, costs reduction, productivity improvement, new industry structure and relationship, new information technology based products or services, as well as enabling a new dimension in the marketing of product (Fong 1999). On the macro level, information technology has the potential in creating national cohesive relationship and extending this relationship to the global level, and opening a new horizon of opportunities. This would speed up globalisation and intensify competition among nations. This potential of information technology has triggered off the pursuit of information technology adoption in the developed nations, in industrialising countries and in some of the trade-oriented developing countries.

Currently, these different groups of countries are at different stages of technology adoption. The developed nations are comparatively more established and experienced in the adoption and application of information technology because they were the early adopters of information technology. Their experience in the adoption and application of information technology generally involved an evolutionary process, in which these countries tend to replace their superseded technology with the new and advanced technology as the latter emerged in the market place. The developing countries were, on the other hand, late adopters of information technology and are more technologically backward than its developed counterparts. With the

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relative ease of access to advanced technology in today's world[1], this raised the question on the possibility of developing countries (which are still using traditional or backward technology) adopting advanced technology immediately (termed as "technological leapfrogging") rather than proceeding by mastering intermediate technologies in turn. Successful technological leapfrogging has significant impact on the technologically backward countries as they are exposed to unprecedented opportunities offer by the new and advanced technology. This paper is established in the interest of determining the possibility of technological leapfrogging by developing countries. It lays out those issues surrounding the concept and the possibility of technological leapfrogging, and is aimed to serve as a initial ground for further research effort in this area. This possibility of technological leapfrogging has major implications for information systems pedagogy and curricula in the developing countries since they are important for equipping users with the skills and knowledge to handle the respective technology adopted for usage.

TECHNOLOGICAL LEAPFROGGING BY TECHNOLOGICALLY BACKWARD COUNTRY

The concepts of evolutionary process of information technology adoption and technological leapfrogging are illustrated in Figures 1 and 2. Figure 1 provides a simplified illustration of the evolutionary process of information technology adoption in the developed countries. This illustration was constructed on the assumption that the stages of technology development could be presented by a neat series of steps and that higher technological superiority is attached to each higher stage of technology development. The diagram shows that costs are incurred by the technologically advanced developed countries in their active adoption of each newly emerged intermediate level of technology and in the displacement of their superseded intermediate technology structures that were incompatible to the newly emerged technology. Figure 2 portrays the concept of technological leapfrogging, in which a technological backward country skips intermediate technologies and goes straight to the latest state-of-art technology.

FIGURE 1
ADOPTION OF INFORMATION TECHNOLOGY IN DEVELOPED COUNTRIES

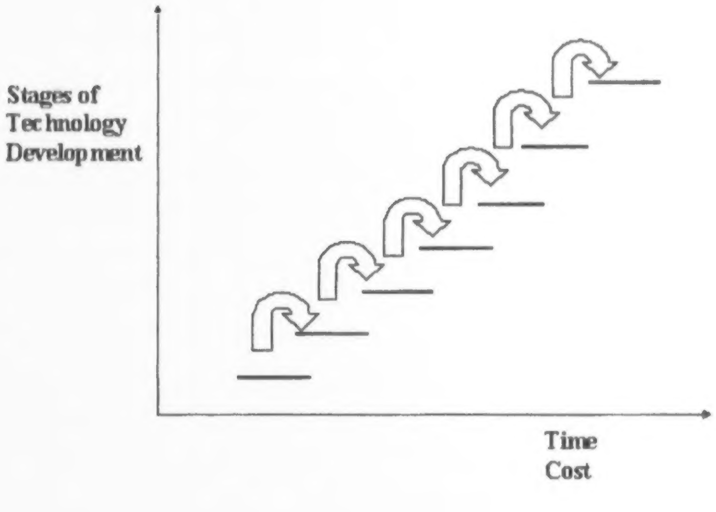
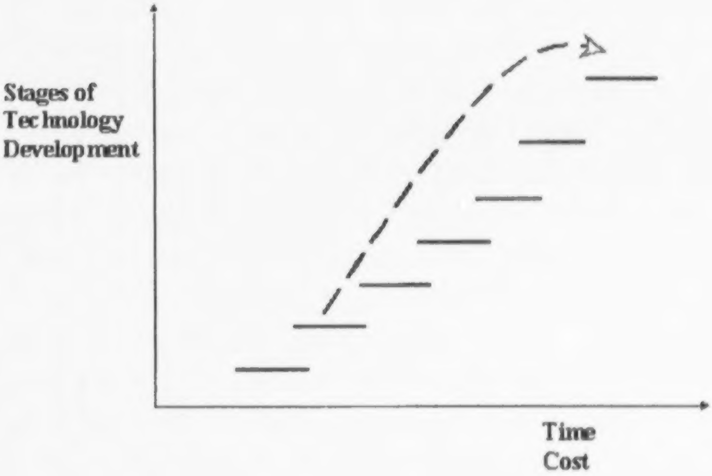


FIGURE 2
TECHNOLOGICAL LEAPFROGGING BY DEVELOPING COUNTRIES



Because the technologically backward country has been inactive in the adoption of each newly emerged intermediate level of technology, it has the option of adopting either intermediate technology or latest 'state-of-the-art' technology (technological leapfrogging) in its late decision to invest in technology for production. According to the World Bank and the Asian Productivity Organisation (Hanna et al. 1995 and APO 1990), information technology provides developing countries with the opportunity to accelerate economic development. The advent of this technology to each higher stage level is commonly associated with greater technological capability potential. Adopting the latest 'state-of-the-art' technology would mean that this once technologically backward country is exposed to the unprecedented opportunities offer by the new technology. These unprecedented technological opportunities were not readily accessible to the advanced countries without incurring (intermediate technology) displacement costs in these countries, due to their previous intermediate technology structure. Thus, the late adopter in technology may be able to avoid incurring the time delays and the costs that were incurred by the advanced countries in their active adoption of each newly emerged intermediate level of technology. The possibility of achieving significant economic growth through leapfrogging to advanced information technology thus seems exceptionally attractive to developing countries.

Research studies (Mody and Sherman 1990, Antonelli 1991, Mody and Dahlman 1992, Lamberton 1994) noted that technological leapfrogging in the telecommunication and computing infrastructure is technically feasible in terms of physical facilities in the developing countries. However, what has remained elusive in this concept is the capability of the developing countries to harness fully the technological potential offered by the radical new technology for economic advantage. Research works in this area are scarce, hindered by limited availability of empirical data from the developing countries and the relatively recent emergence of advanced information technology. It has been argued that empirical case studies on the capability of developing countries in technological leapfrogging are badly needed to answer the crucial question about whether the advantages of technological leapfrogging are within the reach of these countries (Ausubel 1991). According to Sharif (1989), massive resources and a long time span will be involved in gathering reliable data from the developing countries in search of the answer to this question.

The technological leapfrogging concept was first established by Soete (1985), from his observation of the microelectronic industry which allowed rapid industrialisation within the adopting countries. The concept has received recognition of its bearing on information technology applications in the developing countries since the early 1990s (Antonelli 1991, Mody and Dahlman 1992, Lamberton 1994). However, there is limited evidence to determine the actual occurrence of technological leapfrogging in the developing countries involving this new technology. This paper serves as an initial effort to contribute to this relatively new field of study of technological leapfrogging in information technology.

RELEVANCE OF TECHNOLOGICAL LEAPFROGGING

There are particular features of the information technology developments taking place in the past decade, which seem to increase the relevance of this concept to the developing countries. When the following features of the advanced information technology are contrasted against the intermediate information technology, technological leapfrogging seems to qualify as an inevitable move in information technology adoption.

Open Systems

Operating systems that are established under open systems standards can be easily integrated for network formation. In other words, the technical choices of such systems for network establishment are not constrained by vendor, type or vintage, and this provides a high level of communication flexibility. Early information technology had been dominated by proprietary system standards, and the incompatibility among the different manufacturers' equipment and software resulted in incomplete and inconsistent exchange of information. Adopting intermediate technology would mean re-living the problem of technical inflexibility that the advanced countries are experiencing in the 1990s, and which these countries are trying to overcome through open system in advanced technology adoption. The inability of these advanced countries to advance rapidly to new technology adoption is reflective of the inflexible technology infrastructure inherent in the intermediate technology design, due to the earlier pursuit of the proprietary concept in technology development. The new technology, on the other hand, had provided a greater degree of infrastructure flexibility[2], in which consideration is given to the incorporation of future emerging technologies and migration to future technologies without incurring exorbitant costs in technology replacement. In the long run, this flexibility means a lower cost in investment. The adoption of new technology therefore seems to be the most economic alternative, from a wider and longer term in perspective.

Demand on Users

The potential of advanced technology may not be fully utilised or exploited by the developing countries, but the learning paradigm offered by the advanced technology framework has more benefits than that of intermediate technology. Closely related to the advancement in technology is its reduced demand on the prior knowledge and experience of users in technology usage, which is known as the increasingly 'user-friendly' feature of systems. One obvious attribute of this phenomenon is the human-computer interface factor in technology development, which is a rapidly developing area of focus in technology innovating countries. This emphasis is highly evident in funding criteria for technology R&D, training, design development and market demand (Australian Science and Technology Council 1990). Research studies show that an effective human-computer interface has a strong influence on learning curve, performance speed, rate of error and user satisfaction (Shneiderman 1992). It tends to share a strong positive correlation coefficient with the mentioned user-related variables.

Globalisation

The development of information technology applications and the revolutionary potential of information technology also do not suggest that intermediate technology is the ideal choice for adoption. The successful applications of advanced information technology in the developed countries and the Newly Industrialising Countries, such as the Internet, trade networks and banking networks, strongly project a future world economy where globalisation is underpinned by electronic global networks and an electronic global marketplace. This point is also related to the inherent open system characteristic of advanced information technology. The adoption of intermediate information technology by developing countries would involve the heavy price of being excluded from integrating into the global market, especially when the concept of the GII (Global Information Infrastructure) is fully realised. Thus, these developing countries would be in the position of a perpetually technologically backward country, while the developed countries are advancing their vision of a global integration for economic development, through the displacement of intermediate technology for advanced technology.

Thus in comparing the technical attributes of the advanced technology to intermediate technology, there seems to be stronger reasons to leapfrog to advanced technology adoption than to adopt intermediate technology in the developing countries.

OPPOSITION TO TECHNOLOGICAL LEAPFROGGING

The relevance of the technological leapfrogging concept still remains unresolved for developing countries. There are opponents who doubt the ability of the developing countries to take advantage of infomation technology leapfrogging (as found by Hanna et al. 1995). Those who oppose the idea of technological leapfrogging in information technology could make use of two perspectives drawn from technological leapfrogging in generic technology. One is that leapfrogging runs in contradiction to the accumulative nature of the learning process (Pavitt 1984, Hobday 1994); the other is that new technology has a strong tendency to undermine the social structure, and to dismantle the existing stock of human and physical resources (ILO 1985a & b, Wang 1991). In other words, an 'unprepared' (lack of prior knowledge and experience) economy or society would not be able to cope with the new technological paradigm nor to exploit the potential it offers (Jian 1995).

However, it is noted that advanced technology does not necessary brings only hardship to the adopting entities. The social context of a developing country may turn out to favour technological leapfrogging. For example, the status symbol associated with owning a mobile phone has not only led to a quick diffusion of the mobile phone technology in the People's Republic of China, but the social consciousness of being seen with the latest mobile phone model has driven technology leapfrogging in this area in the country. On similar ground, the pattern of mobile phone adoption fits the Chinese business and organisation environment well. This is because most managers of local Chinese companies do not often have the privilege to work in clean and nice offices. The mobile phone technology provides a mobile office environment for them to conduct businesses in more appropriate settings with their clients. Thus, advanced technology may not present the same challenges to organisations from different social environments, its unprecedented potential may befit the social condition of the technology adopting entities.

CONCLUSION

The possibility of achieving significant economic growth through technological leapfrogging seems exceptionally attractive to developing countries. It appears that the possibility of developing countries adopting advanced technology immediately, rather than proceeding by mastering intermediate technologies in turn, is dependent on the type of product (specific technology) in question, the social condition and environment of the country in question. The ideas and thoughts raised in this paper are considered preliminary, and should be tested in practical projects in developing countries which has a technologically backward setting. The author looks forward to similar efforts in exploring the possibility of technological leapfrogging in developing countries.

ENDNOTES

1. This is in contrast to the Cold War period during which some of the developing countries were specifically prevented from procuring leading-edge technology, such as computer hardware, computer software, telecommunications switching equipment and related technology for the possibility of a military buildup.

2. The result of movement towards open systems and standards for system interoperability.

REFERENCES:

Antonelli, C. (1991). *The Diffusion of Advanced Telecommunications in Developing Countries.* Paris: OECD.

APO (Asian Productivity Organisation). (1990). *Information Technology-Led Development.* Tokyo: Asian Productivity Organisation.

Australian Science and Technology Council. (1990). *Your Word Is My Command: Towards An Australian Capability In Human-Computer Interface Design.* Canberra: Australian Government Publishing Service.

Ausubel, J. H. (1991). 'Rat-Race Dynamics and Crazy Companies: The Diffusion of Technologies and Social Behavior.' *Technological Forecasting and Social Change*, 39(1-2) : 11-22.

Fong, M. (1999). 'Information Technology – A Competition Tool and Method.' *International Symposium on Business Administration*. Ed. Jianme He. Shanghai, China: Shanghai International Studies University. 61-64.

Hanna, N. et al. (1995). *The Diffusion of Information Technology: Experience of Industrial Countries and Lessons for Developing Countries*. Washington D.C.: The World Bank.

Hobday, M. (1994). 'Technological Learning in Singapore: A Test Case of Leapfrogging.' *The Journal of Development Studies*, 30(3): 831-858.

ILO (International Labour Organisation). (1985a). *Blending Of New Technologies With Traditional Activities*. Geneva: ILO.

ILO (International Labour Organisation). (1985b). *Technologies Which Are Appropriate For Meeting Social Objectives Of Developing Countries*. Geneva: ILO.

Jian, Z. J. (1995). 'Discussion on constructing the Chinese NII.' *Telecom Product World*, (10): 9-11.

Lamberton, D. (1994). 'The Information Revolution in the Asian-Pacific Region.' *Asian-Pacific Economic Literature*. November, 8(2): 31-57

Mody, A. and Dahlman, C. (1992). 'Performance and Potential of Information technology: An International Perspective.' *World Development*, 20(12): 1703-1719.

Mody, A. and Sherman, R. (1990). 'Leapfrogging in Switching Systems.' *Technological Forecasting and Social Change*, 37(1): 77-83.

Pavitt, K. (1984). 'Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory.' *Research Policy*, 13: 343-373.

Sharif, M. N. (1989). 'Technological Leapfrogging: Implications for Developing Countries.' *Technological Forecasting and Social Change*, 36 (1-2): 201-208.

Shneiderman, B. (1992). *Designing The User Interface: Strategies For Effective Human-Computer Interaction*. Second Edition. Reading, Massa: Addison-Wesley Publishing Co.

Soete, L. (1985). 'International Diffusion of Technology, Industrial Development and Technological Leapfrogging.' *World Development*, 13(3): 409-422.

Wang, I. K. (1991). 'Indigenous and New Technologies for Technology Development.' *Asian Economies*, 79: 5-19.

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EFF-089 (1/2003)